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Supply must be Safeguarded.

THOUGH the more immediately pressing matters with which Parliamentary minds have been occupied prevented the Standing Committee from proceeding as rapidly as might be desired with its consideration of the Electricity Bill, it is perhaps just as well that recent untoward events happened before that measure passed beyond the amendment stage.

It may be that the Acts already contain provisions which adequately cover all recent experiences, and include ample authority for legally proceeding against all who were responsible for interference with the maintenance of electricity supply services. The most remarkable and unexpected action reported in certain areas where councillors, who had been elected as representatives of the public to maintain services, deliberately used their authority to shut them down, must have led to deep thinking on the part of the Electricity Commissioners, the Joint Authorities, the Incorporated Municipal Electrical Association, and others responsible for the future security of electricity supply.

The importance of maintaining continuity of supply has been in the forefront of all questions for many years. Technically and administratively it has been regarded as fundamental—a statutory obligation from which there was no escape, a duty devolving upon the engineer technically and a responsibility resting upon the authority under which he served, to maintain the continuous flow of a vital service for which the State had granted a monopoly. In times past there were prosecutions of undertakings which from various causes were temporarily unable to give service or which failed to maintain the supply at suitable pressure. Where authorities have been able to prove that they have done their best to cope with an exceptional situation, the law has not been exacting. But what shall be said of those who, though as municipal representatives they have shouldered responsibility for looking after the public interests, deliberately cut off all service whatsoever—sinking even to that lowest of all levels which allowed them to deprive hospitals of supply essential to the efficient conduct of operations for the relief of suffering humanity? And where, we may ask, can one find any authority under the Electricity Supply Acts for any discrimination between essential and non-essential supplies? Withholding the supply to any class of consumer for strike reasons can have no legal justification.

Recent experiences seem to us to raise vital issues, and we hope that all that is involved will be fully appreciated by those whose duty it is to introduce any new legislation that may be required to strengthen the weak places against all future attacks on public safety and security. They should consider that all the efforts to secure continuity both by having sufficient plant capacity installed or interconnected and by striving after efficiency of technical equipment, as well as all the advantages of bringing undertakings under Joint Authorities, can be rendered useless if the personnel fail to operate or the local governing authority chooses autocratically to misuse its power and cut off supply to any class whatsoever of ratepaying consumers—part-owners of the undertaking.

It cannot be too plainly stated that councillors are elected by the ratepayers to look after their interests as a whole, and if they deliberately fail in any part of that duty they are traitors, and should be treated as such. Surely the maintenance of a borough's industries, giving employment to people resident in the area and earning profit in the borough, paying rates for the up-keep of the borough services, is a matter of first concern! Councillors and committee-men are servants of the electors, and so are the electrical staff and employés. Those who traitorously impose or authorise the cutting-off of power which is essential to public and private convenience or to any industry—whether there is a national or a local or an industrial dispute in progress does not affect the matter if we have regard to their *raison d'être* as councillors—are guilty of robbing workers of wages, businesses of trade and profit, the State of taxes, and the community of a public service *which is actually its own property*. Men who will do so for no other reason than that the colour of their political or social views places them in sympathy with some self-appointed dictatorial council, are totally unfit to occupy any position of public trust and confidence, and should be subject to suitable treatment under the law of the land, or from Central Government, rather than be permitted to continue in authority until the ratepayers dismiss them at a Borough Council election. They should be rendered ineligible to continue to hold either employment under, or seats on, a Council, for they are a danger to the community.

Powers granted to give supply of electricity involve responsibilities. These must not be lightly regarded, but must be quite beyond all danger of interference due to changes in political thought. There must be heavy penalties, and they must be personal penalties, imposed upon men who, in spite of the fact that their local prestige as councillors or their bread and butter as employés is derived from an undertaking, attempt to shut down their own and others' employment by betraying a trust which has been reposed in them by the community as a whole and by the individual consumers, who naturally suppose that they can rely upon the Council as a contracting party to an arrangement to provide one of the vital services for the maintenance of the working life and safety of the people.

Councils elect committees and appoint officials to control and *run* their undertakings—they do not, indeed *cannot*, give them authority to *shut down*. They have no such power without appealing to higher authorities—neither engineer nor Council, neither committee nor employé—because electricity supply is a service given under monopolistic powers granted by the State. Happily the remarkable incidents which have called forth these comments were exceptional; were it otherwise one would feel that if a policy of municipalisation allowed the continuity of supply to be jeopardised by anti-national parties at whim or in a fit of mental aberration, then it might, even at this date, be necessary to ask seriously whether municipalisation was the right thing after all.

One other thought in closing—areas which acquire for themselves the reputation for being erratic in their regard for vital services will be stamped as undesirable by those who desire to start up new industries, and owners of existing works will be ready to leave at the first convenient opportunity.

Registration of Engineers.

TIRED, apparently, of waiting for the big Institutions to deal with the question, the Society of Technical Engineers has prepared a scheme for the registration of engineers, in the form of a Parliamentary Bill, which has been introduced into the House of Commons by the chairman of the Society's Executive Council, Mr. Herbert Williams, M.P.; but it is not intended to proceed with the Bill before the fullest consultation has taken place with all the interests concerned. To this end, copies of the Bill have been forwarded to the leading engineering bodies for consideration with a view to securing general agreement, and the Society suggests that the matter should be referred to the Engineering Joint Council.

In an introductory memorandum it is pointed out that a somewhat similar measure was passed into law in Italy in 1923, and that in the State of New York an Act of the State Legislature provides for the registration of engineers; moreover, the Royal Society of British Architects is preparing a Bill for the registration of architects. The present Bill contains provisions enlarging the powers and functions of the principal engineering Institutions, which would be brought into the closest relationship with the operation of the scheme if it became law.

With the objects of the proposal we are entirely in sympathy, though many points will call for the closest scrutiny, and in view of the deliberation with which such matters are handled in this country, it is questionable whether it will become an Act within the life of the present Parliament. That the term "engineer" is continually misapplied in the lay Press and in popular usage, is only too well known to those who are entitled to use it, and the ready adoption of the epithet "chartered" by members of the Institutions which are incorporated by Royal Charter is evidence of their desire to obtain a distinctive appellation; but the trouble resides in the fact that the language itself is made and moulded by popular usage, and if the public continues to regard a mechanic or a fitter or an engine-driver as an "engineer," all the Acts in the Statute-book will be unable to turn it from its purpose.

The community has no conception of the part that is played by the engineer (in the correct sense) in its daily life; water, electricity, gas, and transport are only a few of the services for which he is responsible—but he is a "dumb dog," and neither tries nor cares to secure his rightful position in the public eye. Whether the enterprising action of the Council of the S.T.E. will be rewarded with eventual success we cannot tell; it has our sympathy, and we hope that at least it will receive full consideration by all concerned.

The I.E.E., the I.M.E.A., and the Bill.

THE annual report of the Council of the Institution of Electrical Engineers, whilst containing no sensational items, records a very satisfactory year's work. The membership at March 31st was well over 12,000, showing a steady net increase of about 400 a year, and the activities of the main body and its numerous branches and committees were more than maintained, 374 meetings having been held during the year. From the summary which appears on p. 857, it will be observed that there are now nine "Technical Committees," which will endeavour to improve the supply of suitable papers; that the Committee on Electricity in Agriculture is doing good work; that the Council has submitted recommendations to the Electricity Commissioners for the amendment of their regulations for electricity supply; and that attention is being given to the question of status of engineer officers in the Royal Navy. Unfortunately, owing to lack of interest in the establishment of a national proving house, the proposal, so dear to the late Mr. Wordingham, has been dropped.

Conspicuously wanting is any reference to the most important question now before the electrical industry—the Electricity (Supply) Bill. On March 29th the Council of the Institution submitted to the Government

a grave warning to the effect that the provisions of the Bill were based upon a misapprehension of the facts; in the opinion of the Council they might prove detrimental to the progress of the industry, and it was considered of the greatest importance that an inquiry should be held before the Bill became law; but it was elicited from the President at the annual meeting that no further steps were contemplated by the Council, the various sections of the Institution being left to speak for themselves. But the Council cannot have it both ways: either, for the reason stated, no action should have been taken at all; or, having decided to enter a vigorous protest against the Bill, the Council should have been prepared to follow it up with energetic measures to press the protest home. Half-measures "cut no ice." At least we should have thought that a meeting could have been called, informal or otherwise, to enable the members to discuss the Government's proposals and to record their views thereon. Unless that is done, the Council's protest will fall on deaf ears.

The Council of the Incorporated Municipal Electrical Association, not for the first time, has grasped the nettle more courageously, and last week convened a special general meeting of its members, who admittedly have a common and immediate interest in the subject. The meeting passed a resolution, of which the terms are given on p. 840, expressing the belief that in its present form the Bill will fail to attain its object—the cheapening of electricity supply—and proposing that the industry should be consulted before any legislation is enacted. That view, it will be remembered, has been repeatedly put forward by Mr. R. A. Chattock, President I.E.E. The resolution also throws doubt upon the figures and conclusions of the Weir report, and deprecates the suppression of the Merz report. As our readers are aware, we are entirely in accord with the purport of this resolution, as well as with the protest of the I.E.E., both statements having been anticipated in our columns by many weeks. But why has action been deferred until the Bill is actually in Committee? Certainly neither the I.E.E. nor the I.M.E.A. can be accused of "undue haste."

The Radio Exhibition.

In our "Business Notes" this week we give some particulars of the National Radio Exhibition, which is to be held at Olympia in September. It will be seen from the note that although the show is being organised in the name of "N.A.R.M.A.T.," the Society of Radio Manufacturers is taking a hand, and in our opinion this co-operation is all to the good, preventing the inevitable overlapping and jealousy which the holding of two separate exhibitions would engender. The necessity for two exhibitions has been eliminated by the wise decision of the organising associations not to confine the exhibition to their members only. As we said last year, an exhibition of that character cannot fail to be incomplete and unrepresentative.

The early entrants to the Exhibition are to be allotted space by means of ballots, a method of which no one should complain, for any other system generally brings disputes in its train. British goods only are to be displayed; this, too, is satisfactory, for British manufacturers are now able to produce practically everything that is required in the way of radio apparatus, even if their prices are sometimes just a trifle higher than those of imported products. The decision to ban loud-speaker demonstrations may disappoint a few exhibitors, but the majority will realise that a dozen loud speakers at full blast, some of them reproducing different programmes, will not appeal to the ears or pockets of the visiting public, apart from other considerations. Ordinary telephone demonstrations are in a different category, but for some reason these, too, have been banned.

We see no reason why this Exhibition should not be successful and help to restore harmony in an industry which cannot thrive as it should if divided into hostile parties.

A Clearing-House for Information.

THE paper on the above subject, read by Mr. W. J. Pearce at the last meeting of the Circle of Scientific, Technical and Trade Journalists, raised points of great interest, alike to the technical journalist and to men of science. He pointed out that the amount of valuable scientific and technical "fact-information" was rapidly increasing, and that the public appetite for such data had also grown. Yet the bulk of such information remains locked up in special libraries—often unknown to the man most in need of it. On the Continent, comprehensive schemes of indexing all available knowledge have been attempted, but we think most people would agree with Mr. Pearce that they are too complicated for ordinary life. The average man wishes to be able to get information quickly and easily. Reference was made in the discussion to the simplicity of the arrangements at the Patent Office Library, and a letter from Mr. Bradford, the Director of the Science Museum, South Kensington, was read, drawing attention to the great resources of this special library, which ought to be more widely known. Mr. Pearce explained the aims of the Association of Special Libraries and Information Bureaux, and advocated the establishment of a clearing house, where inquirers could be put in touch with the best sources of information. There are in this country many other special libraries besides the two mentioned, and it would certainly be an advantage if some method of linking them together and making their existence and resources more widely known could be evolved.

Meetings in June.

IN recent times June has become one of the busiest months in the electrical year—at least, that is how it appears to the technical Press—and this year it was to have been more crowded with events than ever; however, fate has ordained otherwise, and in a country which practically lives on coal, the lack of that commodity has necessitated drastic changes in many programmes.

The Summer Meeting of the Institution of Electrical Engineers has been postponed till next year; the annual meeting of the Association of Mining Electrical Engineers, which opens to-day, will be confined to the transaction of formal business, the social events and visits being abandoned.

However, it is satisfactory to be able to announce that the annual convention of the Incorporated Municipal Electrical Association at Glasgow, the principal event of its kind, will be held according to plan. It is true that some modifications in the lighter side of the programme may be found necessary, but up to the time of writing we understand that no change is in contemplation. The members, of course, will not expect to find that the arrangements are in every respect as perfect and efficient as the admirable record of the Association in the past would lead them to anticipate if normal conditions prevailed; the circumstances are abnormal, and have hampered the preparations of the secretarial staff, delaying the issue of the programme, but those who propose to take part in the Convention must make allowance for the difficulties which confront its organisers, remembering that a gathering of 600 or 800 people is no light matter to handle at the best of times.

The first annual convention of the Electrical Contractors' Association will be held at Brighton as arranged, and so will that of the Tramways and Light Railways Association at Torquay, in the same week. The conversazione of the I.E.E. will take place whilst both these events are in progress, and once more we have to regret the clashing of programmes of electrical bodies; apparently a sort of clearing house for conventions is needed. Not many have the leisure or perhaps the stamina to enable them to take part in a succession of summer meetings, but some would certainly wish to attend more than one. Possibly next year the difficulty will be met by the holding of one big electrical convention on the lines which we have already indicated.

Transatlantic Photo-Telegraphy.

The Transmission and Reception of Photo-Radiograms.

RECENT announcements and pronouncements would seem to indicate that the art of picture transmission has suddenly been born; whereas its inception dates from almost the same time as the invention of straight telegraphy, for in 1842 Alexander Bain, an English physicist, first proposed a device for sending pictures from one place to another electrically along wire circuits.

His idea is so basically correct, coupled with simplicity, that all later investigators have, generally, followed his method. A system devised for use on the long-distance Bell telephone network in the U.S.A., which includes very good-quality circuits, has been outlined,* and the feature at present under consideration is the utilisation of a radio-telegraphic circuit for the purpose. Apparatus has been installed in London, New York, and San Francisco for the establishment of a regular, reliable service for the transmission and reception of news photographs, facsimile printed and written documents, or tabulated matter, designs, &c., *via* the 220-mile land line from London to the Carnarvon (North Wales) radio-telegraph station of Marconi's Wireless Telegraph Co., Ltd., thence across the Atlantic Ocean to the Riverhead station of the Radio Corporation of America on Long Island, and further on by land lines.

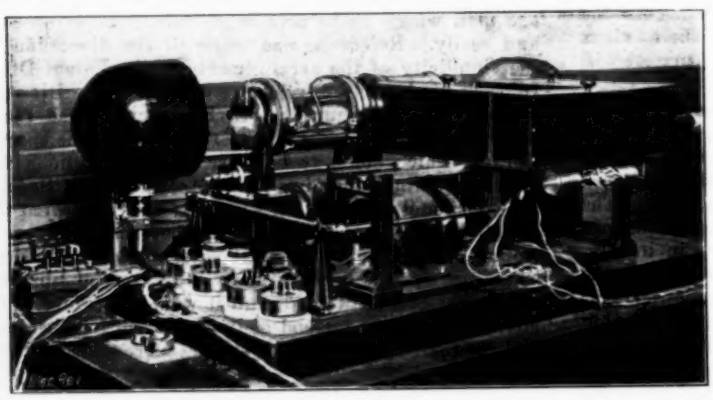

Fig. 1.—Photo-radiogram Transmitter at Radio House, London.

The basic elements of all picture transmission are, first, a synchronous action covering a surface point by point at both transmitter and receiver, and, secondly, the electrical identification of the point value to correspond between transmitter and receiver; and when Capt. R. H. Ranger, and the Radio Corporation of America, undertook the development of his system he soon realised that the solution of his main problem was an economic one rather than that of producing a machine that would work.

Practically every system is based on the division of the picture into small unit areas and the transmission of their values one after another, but when it is realised that the usual newspaper half-tone (and none too good a one at that) has, at least, 65 dots in a row per inch, or more than 4,000 of them to a square inch, the size of the job becomes apparent. Analysed in this way, the usual method of picture transmission found its serious drawbacks in the number of pulses that have to be transmitted and the precision and the time needed to do so. Search for a "shorthand" method of accomplishing the same results was then started. The first effort in this direction consisted of variable dot-spacing, making each dot of generally the same size, so that by their grouping they constituted the shades of the picture. The dots were so chosen that, in size, they would occupy a space of approximately one-fourth of the 64th of an inch (the usual newspaper standard), one such dot per 64th of an inch giving an impression of gray colour; if spaced further apart, gray would give way to white; if spaced closed together, gray would become darker, and for almost black the spacing would be approximately two dots to each 64th of an inch. An advance was accordingly made from the necessary five values of the older systems to two for each 64th of an inch; this dot concentration was carried a step further by starting with separately grouped dots in the white end of the scale and increasing to the densely concentrated dots as before, but the receiver drum is given twice the speed of the movement, so that the spacing which formerly produced black now gives a middle gray. Then, to accomplish the further deepening to the black, each of the dots grouped closely together are lengthened so that they become heavier and heavier, and finally for solid black the transmitter is held constantly. The apparatus is a balanced arrangement, such as the familiar "push-pull" type of amplifier; one side of the outfit works in progression from white to gray and the other side in the light progression from gray to black, with a slight overlap at the centre.

The reduction that is thus accomplished over the previous method is 2 to 1, so that a 5 to 1 overall improvement has been made, which means that with a fixed available speed for the transmission of individual units, the process enables five times the area to be covered in the same length of time. Furthermore, a wide range of tones is secured without abrupt changes from one tone to the next, and the individuality of the alignment of the sharp edge can be made very precise providing the synchronising of the motors is sufficiently accurate.

Fig. 2.—Capt. R. H. Ranger and his Receiver.

The photograph or document to be transmitted is copied photographically, either as a negative or positive, on to a transparent celluloid film that is mounted on a horizontal glass cylinder (to be seen in fig. 1) at one end of which a tungsten-arc lamp (15,000 c.p. per

* See ELEC. REV., July 24th, 1925; pp. 139-41.

sq. in. of surface) is housed in a dome reflector, the beam of light being directed through a system of lenses longitudinally down the cylinder on to a 90-deg. prism which directs the beam radially outwards through the film; the latter being situated at the focus of the lens system, the light passes through small areas of the film progressively, the intensity of the issuing beam depending on the density of the particular portion of the image through which it emerges. Another system of lenses and mirrors directs the light ray on to a light-sensitive cell with varying intensity according as the optical system is moved forward parallel to the film cylinder; the latter is rotated slightly at the end of each stroke so that the light ray traverses the whole picture in a series of parallel horizontal lines. The photo-cell, which interprets light valves into terms of electric current, was developed by the General Electric Co., of America, and the Westinghouse Electric & Manufacturing Co. It is of the glass-bulb thermionic pattern, and somewhat resembles a large radio valve; the basic idea of its operation is the application of a high voltage, almost sufficient to ionize it, photo-electric action being realised when light strikes the photo-cell so that the potassium hydride which lines its inside surface is ionized and electrons pass from the potassium hydride to the cathode in the centre of the cell. Highly attenuated argon gas fills the inside of the cell and increases the ionizing effect materially, so that an appreciable current flows through the cell with the action of the light (to the extent of some two micro-amperes). This current, of course, must be greatly amplified by the use of three-electrode vacuum valves; in a typical circuit, the current is caused to pass through a high resistance, which causes voltage variations to be applied to the grid of the vacuum valve. Such amplification might be carried on in further steps in the usual manner, but for the first dot-concentration plan this was quite sufficient in itself to give effective results. A vacuum valve with its grid thus controlled by the photo-cell has its plate current applied through a condenser charged at intervals, which are determined by the rate at which the condenser discharges; in other words, a sort of low-pressure valve is arranged such that when the condenser discharges to a certain extent, the plate battery is again connected to the condenser to charge it up to the maximum value. This is accomplished by having a large C battery connected to the high side of the condenser and so biased that the plate voltage must fall below a given value before a second three-electrode valve stops drawing plate current through its plate. This second plate current is carried through a relay; while the relay coil is energised the contacts are open, but when the relay falls back against the contacts the charging B battery pulse is sent on to the condenser. Thus the time interval between the successive charges of the condenser is determined by the rate of the plate-current flow in the first vacuum valve, and as this is, in turn, determined by the photo-cell current, a direct interpretation of the light action is obtained in terms of the relay closing which can be used to activate telegraph lines or a radio-telegraph circuit.

An interesting adjunct to the photo-cell is the use of an additional light beyond the normal illumination obtained through the film to be transmitted: it has been termed the C light, and corresponds in its action very much to the C battery used in grid amplification. The use of the C light makes it possible to operate the photo-cell itself more effectively, so that, in conjunction with the amplifiers, it gives a more perfect straight-line characteristic to the reproduction current values.

For synchronizing, a tuning fork gives the appropriate constant rate of rotation to actuate both transmitter and receiver; by the addition of clock check control it has been found possible to obtain uniform speeds at each end, where the clock controls act as a check on the tuning fork. Further, use is also made of dashes at the end of each stroke, which serve to keep the receiving cylinder moving correctly with respect to the transmitting cylinder.

The receiver (fig. 2) may be of various forms; in the present case it is suitable for receiving continuous-wave telegraph signals by the heterodyne-beat method and, following rectification and amplification, the received impulses are made to actuate a siphon recorder mounted on a travelling carriage that is operated by a tuning-fork controlled motor, so that its movement is in synchronism with that of the carriage carrying the optical system of the transmitter. After each stroke of the carriage the paper roll is moved forward slightly more than the width of the lines formed by the pen of the siphon recorder, the horizontal row of ink dots and dashes thus made side by side eventually completing the picture. The amplifier at the receiving end (fig. 3) includes a valve-controlled condenser similar to that at the transmitting end, its function being to overcome the inertia of the siphon recorder and render the latter's action more rapid and certain.

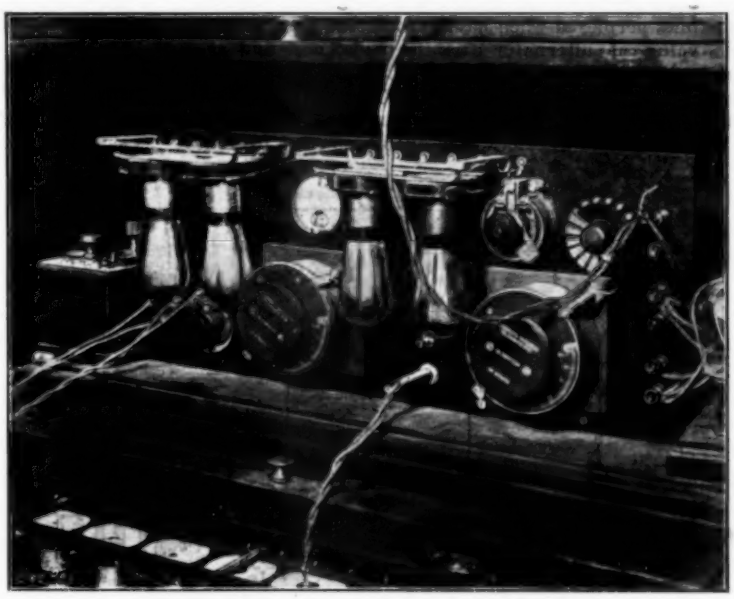

Fig. 3.—Receiving Amplifier at Marconi's Main Telegraph Office.

The photogram receiver is capable of making two pictures at the same time, or duplicating one picture, and a film box may be added for obtaining a photographic record at the same time as the visible one is being made. Naturally, when the pictures are reduced in size, their artistic effect is greatly enhanced. Anything up to a photographic half-plate in size can be handled by the plant installed in London, the transmission of a picture of quarter-plate size occupying about 15 minutes.

In such a development it is natural that those who see only the general effects of the work may not appreciate the effort that had to be expended on all the details involved. Actual measurements showed that a film which varies in its ability to transmit light from 25 per cent. at the darkest portions to 80 per cent. at the lightest portions gives the best results. To organise operations on a practical basis a very extensive study of photographic copying had to be made; for example, with a given fixed original, it is possible to get a wide variation in the transparency of the copy by changing either the exposure time in the copying camera, or the development time; also it is possible to get a still wider variation by using different types of films. Such information has been drawn up in the form of a single table, so that the practical operator can obtain from any given

original the copy which will have the exact range desired.

Electrical transmission to a distance always necessitates obtaining sufficient signal strength to over-ride the effects of disturbances. It is in this respect that the telegraph wins, due to the fact that it is in a sense a trigger device, so that it is easier to identify electro-mechanically the times when the current is " on " and when it is " off," than to attempt to analyse variations in current strength. By interpreting picture values in dots and dashes (involving full current of the radio transmitter being " on " even for the shortest dot) full advantage has been taken of this telegraphic supremacy to carry a picture to the greatest distance. Furthermore, it lends itself most readily to relaying operations by means of both wire and radio circuits.

Naturally, refinements remain to be introduced to render the equipment continuously serviceable, so that both transmitter and receiver may operate without interruption between pictures; the equipment now set up is working both eastward across the Atlantic and westward to California and Honolulu, and it is only a question of time when the mechanics of the operations will have been sufficiently mastered by the operators to make photo-radiograms of service to everyone.

On Determining the Value of Earthing Resistances for Alternator Protection.

Typical and Special Arrangements are Indicated.

By B. NUTTALL, A.M.I.E.E.

THE following notes are intended to help those who are sometimes perplexed when having to decide upon a suitable value of alternator earthing resistance, and are based upon the assumption that the neutral point of one generator only is earthed. Two such typical arrangements are shown in figs. 1 and 2. In the case of fig. 1, a simple interlock is desirable, so as to prevent more than one switch being closed at a time. Fig. 2 ensures that it is impossible for the latter condition to exist. Although not indicated in these figures, the machines are connected solidly to the busbars—or else, as indicated in fig. 3, a separate resistance is furnished for each machine, as each alternator constitutes a separate and distinct system.

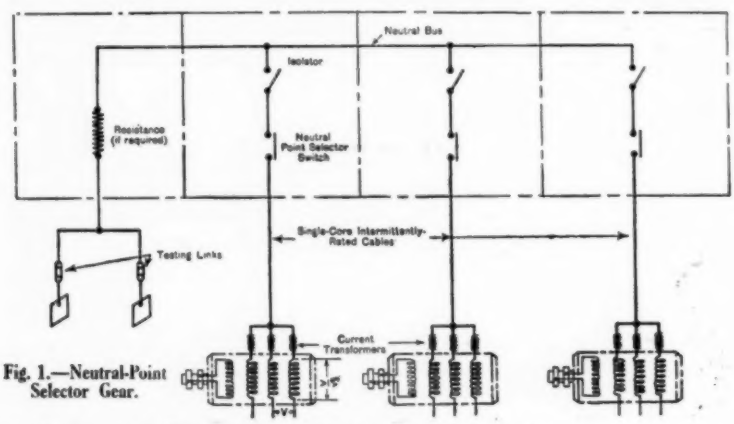

Fig. 1.—Neutral-Point Selector Gear.

For systems as indicated in figs. 1 and 2, it is the usual practice to select the neutral point of one of the largest or strongest machines, so that it may take all the stresses due to earth faults.

The object of earthing one alternator neutral point only at a time with machines coupled solid to the busbars is threefold:—

(1) To keep the resistance between the neutral point of the system and earth constant—that is, the maximum current flowing on a fault to earth—independent of the number of alternators working in parallel, otherwise the leakage current may vary over a wide range. If no resistance is employed, this method limits the value of the earth current to the capacity of one machine.

(2) To avoid interchange of triple-frequency currents between machines. Also in the event of a bad synchronising shot, to prevent a cross-current circulating between machines.

(3) To avoid multiplicity of earthing resistances.

The arrangement, however, suffers from the disadvantage that an earth fault causes a rise in potential on the neutral busbar.

The following examples assume that the machines are protected by the Merz-Price circulating-current system of protection.

Effect of Varying the Value of Resistance.

Assume that for a certain 6,600-volt, 3-phase machine, as shown in fig. 4, the circulating current relays are set to operate with 76 amperes out-of-balance across the winding. With an earth fault on terminal X, the full phase voltage is available to drive 76 amperes through the resistance, which can have a value of $6{,}600/76\sqrt{3}=50$ ohms. Assume that the fault takes place at Y, 60 per cent. along the phase winding; this permits 60 per cent. phase voltage drop across the resistance (neglecting the resistance of the earth return), thus corresponding to $50\times0.6=30$ ohms. Similarly with a fault at Z, 10 per cent. along the phase winding, the limiting resistance would not have to exceed 5 ohms. This clearly shows that the value of the resistance depends upon the degree of protection desired for the generator.

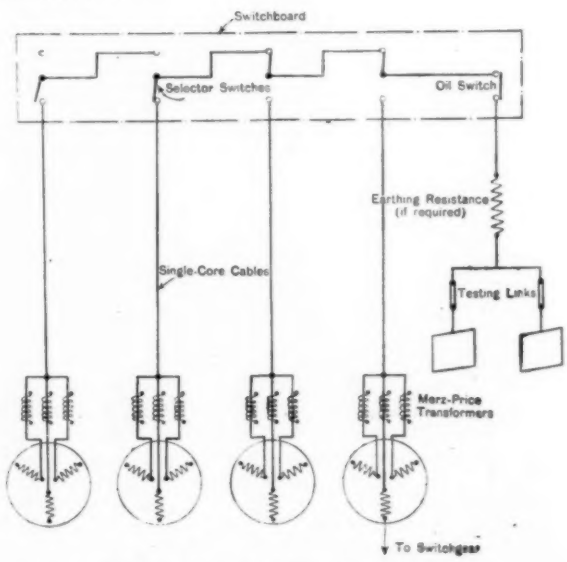

Fig. 2.—Neutral-Point Selector (Throw-over) Gear.

It will be observed that with a fault at Y the full phase

voltage (v=3,800) is impressed across the resistance for a period corresponding to the time required for the automatic field-suppression gear to reduce the field current to zero. This is only a momentary period, and as thermal capacity is not necessary in the resistance,

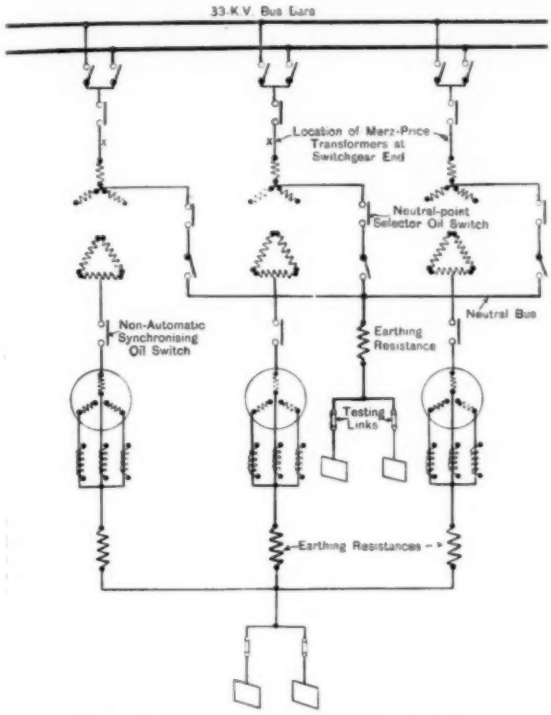

Fig. 3.—Earthing Arrangement with Separate Systems.

it is usual to design the resistance to carry the predetermined earth current for 30 seconds with a temperature rise of, say, 200 deg. C.

Varying Degree of Protection of Alternators with Limiting Resistance of Constant Value.

Not infrequently it occurs that the capacity of a power station is increased to a value several times that of the original scheme, and a review of the protective arrangements is necessary. Fig. 5 indicates such a condition, turbo sets A and B comprising the initial

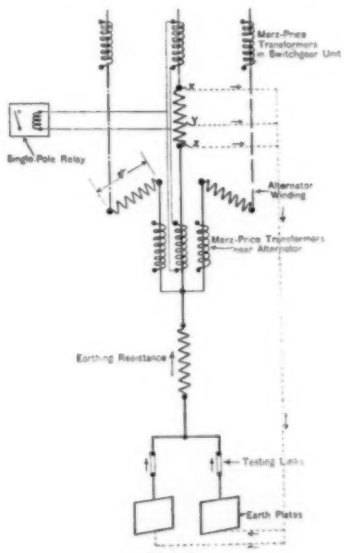

Fig. 4.

installation; set C was subsequently added, but the additional cost involved in modifying the value of the resistance preponderated over the advantage secured by the increased protection to set C. With the installation of sets E and D the resistance was re-modelled and its value adjusted to enable it to pass the normal full-load current of the largest machine, *i.e.*, 1,000 amperes with normal phase voltage impressed across it. In the following examples the original value of the resistance is retained so as to indicate the varying degree of protection afforded to the different sizes of machines.

Assuming that the limiting factor is the degree of stability of the protective transformers obtained, a relay setting of, say, 0.93 A will be taken to ensure that the relay will not operate with a straight-through current equivalent to twenty times normal full load.

The original resistance was designed to pass 300 A for 30 seconds, which corresponds to a resistance of 3,800/300=12.66 ohms.

Machine A.—With 250/5A protective transformers, *i.e.*, 50/1 ratio, the corresponding primary out-of-balance current is $50 \times 0.93 = 47$ amperes.

The unprotected portion of the winding would now be $12.66 \times 47 \times 100/3.800 = 15.7$ per cent., *i.e.*, a protected portion of (100−15.7) per cent., or 84.3 per cent.

Machine B.—The transformer ratio is 60/1. The primary out-of-balance current in 55.8 amperes, implying a drop of $55.8 \times 12.66 = 706$ volts across the resistance. Thus the unprotected portion is $706 \times 100/3,800 = 18.6$ per cent., giving a protected portion of 81.4 per cent.

Machine C.—Similarly the unprotected portion is $941 \times 100/3,800 = 25$ per cent., giving a protected portion of 75 per cent.

Machines D and E.—Similarly for each of these machines the unprotected portion is $2,360 \times 100/3,800 = 62$ per cent., giving a protected portion of 38 per cent.

By employing the M.V.E. modified Merz-Price system (S. L. Pearce's patent) and retaining the same value of limiting resistance, more favourable conditions are secured. With this system a much lower relay setting may be employed. Assuming a setting of 0.35 A, the unprotected portion of machines D or E would now be reduced to $886 \times 100/3,800 = 23.3$ per cent., giving a protected portion of 76.7 per cent., as compared with 38 per cent. with standard Merz-Price gear.

The following indicates how the same results may be obtained by employing a formula:—

Let v = Phase voltage.
$\imath$ = Normal-load current of generator.
i = Primary out-of-balance current.
a = Relay setting = Primary out-of-balance current/normal load current $\times 100 = i/\imath$ per cent.
$\imath_e$ = Maximum earth current.
R = Ohmic value of resistance.

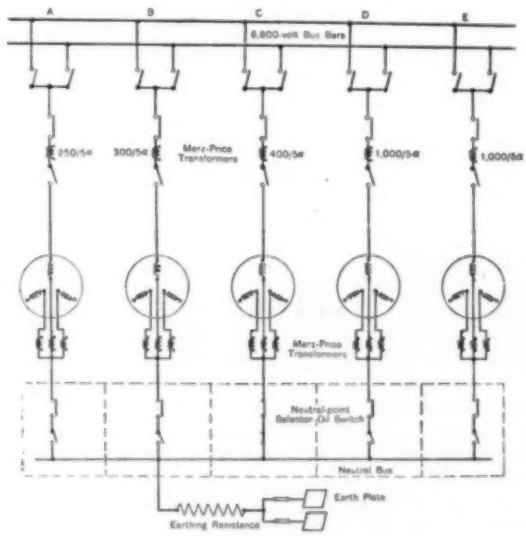

Fig. 5.

Percentage of winding unprotected = $R \times i \times 100/v$, but $R = v/\imath_e$ and $i = a\imath$.

∴ Percentage of winding unprotected = $100\ a\imath/\imath_e$.

∴ Percentage of winding protected = 100 (1 − relay setting × normal load current/maximum earth current) or winding protected = 100 (1 − out-of-balance current/maximum earth current).

Assuming that as an average value $a = 15$ per cent. for

standard M.-P. gear and 7 per cent. for the modified system, the protected portion of the winding can now be readily arrived at for varying values of the resistance so that a suitable value may be selected:—

A Percentage of winding required to be protected.	B % relay setting (a).	C Load current/max. earth current = 1/1
85	15	1
70	15	2
45	15	3
92	8	1
84	8	2
76	8	3

The figures in column A are obtained, as shown above, from the formula by mutiplying those in columns B and C and subtracting from 100.

The percentage of generator winding protected may be more readily obtained by plotting the primary out-of-balance (*i*) or leakage current in amperes as the ordinates and the maximum earth current (I) as abscissa, as indicated in fig. 6. Should the out-of-balance and earth-current values exceed those indicated, the curves may still be used by referring to both ordinates and abscissa as a percentage of the normal load current. The resistances of the fault and ground return are neglected.

Whilst determining the most suitable value of resistance when referred to the generator protective gear, it must not be overlooked that occasionally this value may have to be increased to ensure operation of the feeder protective year. If the latter embodies leakage protection, which even with a direct trip set, say, at 25-30 per cent. normal load, the resistance would be quite large enough for this purpose if it permitted 50 per cent. of the load current of the largest feeder to pass. If, however, plain overload protection only is provided and it is desired to protect against earth faults as well as phase faults, the resistance will have to have such a value as to permit the operation of the breaker on the largest feeder when the trip gear is at its maximum setting, unless fused trip coils are employed.

It sometimes may happen with a large-current low-voltage machine that economical considerations may permit only of the employment of direct tripping Merz-Price gear and connecting the neutral point solidly to earth. If a resistance were employed in such a case to pass the full-load current of the machine, the cost would be prohibitive. Such a case is shown in fig. 7, where a 1,000-kW, 3-phase, 350-volt generator composed the initial installation, and on extensions being necessary it was decided to generate and transmit at 6,600 volts, thus necessitating a step-up transformer for the low-voltage machine. With the arrangement indicated, the neutral of the second system (6,600-volt) could be selected from either of the direct-coupled machines or from the secondary side of the generator-transformer circuit. As is customary, the resistance for this system was designed to pass approximately the full-load current of the largest machine with full phase voltage impressed across it—*i.e.*, 150 amps.

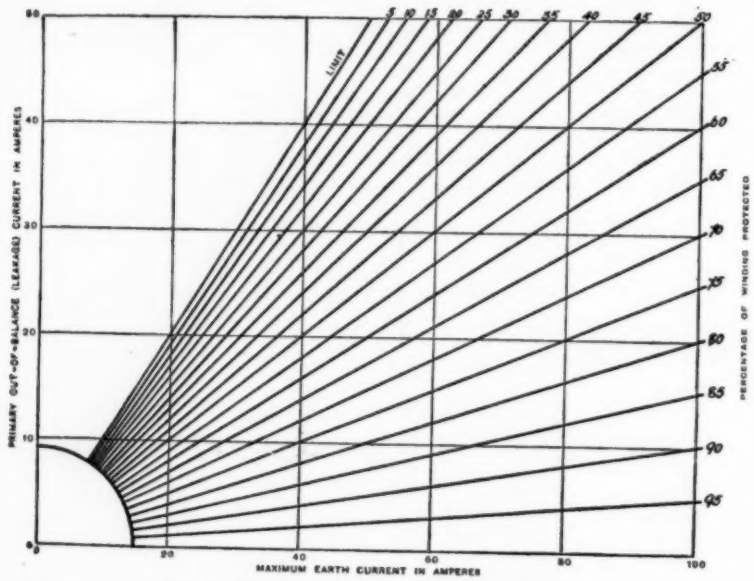

Fig. 6.—Percentage of Generator Winding Protected.

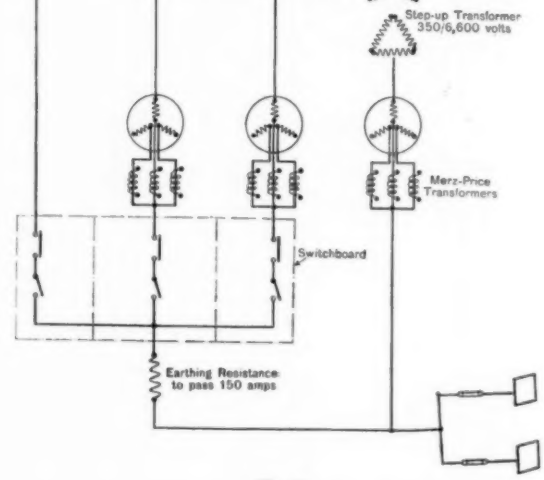

Fig. 7.

It may happen that a section of the system is found wherein no neutral point is available for connection to ground. In such a circumstance, to ensure uniformity of the operating conditions, special provision has to be made, an artificial neutral point being generally provided. Although this requirement may be met by using a transformer adapted for star connection to that side of the system and connected in delta on the secondary side, it is more usual to provide a three-limbed reactor having two coils in each limb, which coils are connected in zig-zag formation, as shown in fig. 8. Full particulars of this "zig-zag" transformer may be obtained on referring to the "J. & P. Transformer Book" by Messrs. Stigant and Lacey.

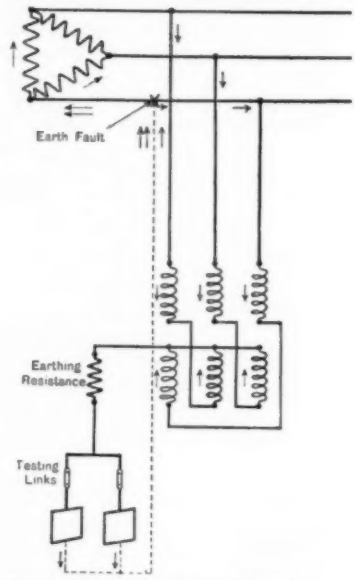

Fig. 8.—Zig-zag Transformer Formation.

The I.E.C. Meeting in America.—IV.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

A NUMBER of recommendations are being made to the National Committees in the domain of graphical symbols for telegraph, telephone, and radio diagrams, in connection with which it is hoped that agreement will be reached in favour of definite adoption at the next session of the I.E.C.

The Advisory Committee on Terminal Markings, under the chairmanship of Dr. Strecker (Germany), was only able to review the present practice in various countries in a general way.

The question of obtaining international agreement is an extremely difficult one, since each country has already adopted the scheme which appears most to meet its particular requirements, and to make any change would be an expensive process and one liable to lead to confusion in the interim. However, the importance of international agreement is fully recognised, and it is hoped that by the time of the next meeting of the I.E.C. it may be possible to report a definite step forward in this matter.

The first decision of the Rules and Regulations Committee working under the chairmanship of M. Uytborck (Belgium) was to confine all discussion to overhead lines, underground construction being deferred to a later date. The Belgian Delegation, in accordance with decisions formed at a previous I.E.C. meeting, had prepared a draft set of standard rules. The German delegation circulated schedules showing the various rules and regulations in force in Germany, along with a proposed standard code.

The British delegation put forward proposals which supported generally the Belgian draft, and, in addition, suggested a method by which it would be possible for all countries to base their requirements, as regards the construction of wires and supports, on a simple formula containing a coefficient to meet the climatic conditions in the various countries in place of the various present methods of arriving at the design in different countries.

The British proposals, which were advanced by Mr. Ll. B. Atkinson, were at first subjected to considerable adverse criticism, but the discussion removed misunderstandings, and the merits of the system were recognised to such an extent that agreement was reached on the desirability of preparing standard regulations.

The Belgian Committee was instructed to obtain particulars of the regulations in force in all countries supporting the I.E.C., and on that information to formulate proposals for international agreement.

A council meeting was held at the close of the technical sessions on April 21st to discuss various matters of internal organisation, including the question of the election of the president. It was found necessary to bring the Statutes of the Commission into line with modern requirements, as they had not been modified since laid down in 1906.

Signor Semenza was unanimously re-elected president of the Commission, a decision which will receive world-wide support. Colonel Crompton, who has been the honorary secretary of the Commission for so many years, was promoted to honorary president, and Sir Richard Glazebrook was nominated as honorary secretary, which, in view of his forty years' experience of international work, is a happy augury for the future work of the Commission.

The question of revising the Statutes was referred to the Committee of Action in order that it might prepare definite proposals for the consideration of the various national committees. The Committee of Action will also be called upon to co-operate with the new international organisation on standardisation.

The Council does not, of course, deal with technical matters, so that the decisions of all the technical committees were referred to the final plenary meeting held on April 22nd by the individual chairmen, and in all cases were ratified.

The work of the Committee of Action since its inception at the Paris meeting was also ratified. It will be recalled that the Committee of Action was appointed by the Council to meet and consider important matters during the intervals between the general meetings and to keep the national committees informed.

A meeting of the Committee of Action will be held in Europe during the next few weeks to consider representations formally received from the new International Standardising body for close co-operation. This request was presented to the Committee of Action by Mr. C. E. Skinner, the chairman of the National Conference, Mr. Enstrom (Sweden), and Sir Richard Glazebrook (Great Britain).

Close co-operation between the I.E.C., now in being for more than twenty years and acknowledged by Governments, and the new body will have a far-reaching information and promulgation of international agreements, and the new body will have a far-reaching effect. A criticism has been levelled at the International Conference as being a hole-and-corner affair,* as it is obvious to anyone having experience of such meetings that the freedom of discussion necessary to come to an understanding would have been impossible at a public meeting.

The Conference, which has assumed formal shape in New York, is not the result of a sudden thought, but is the culmination of a series of deliberate steps originating with the national standardising bodies, which in most countries are supported by the industry as a whole.

The wonderful hospitality extended by the American reception committee to the visiting delegates throughout the New York meetings was brought to a fitting climax by a banquet at the Hotel Astor during the second week, when the Mayor of New York welcomed the Commission. Felicitous speeches were made by Signor Semenza (Italy), Monsieur E. Mytborck (Belgium), Professor Feldmann (Holland), M. Domingo Santa Maria (Chile), M. E. Huber-Stockar (Switzerland), Sir Richard Glazebrook (Great Britain), Dr. John W. Lieb (U.S.A.), and Professor Luigi Lombardi (Italy).

Later in the week the delegates tendered a dinner to the United States National Committee, under the presidency of Dr. Guido Semenza. In complimenting the committee on the remarkable kindness and thoughtfulness displayed in every detail of the arrangements for the Conference, Dr. Semenza mentioned specially the names of Dr. Lieb, Mr. Frank W. Smith, and Dr. Clayton Sharp. As a token of the delegates' appreciation of their magnificent reception, the president presented, on their behalf, a delightful souvenir of the visit in the form of a bronze copy of the well-known ancient statue of Victory, in Naples.

On Friday, April 23rd, the serious work of the Conference being completed, the delegates, accompanied by a number of American and Canadian hosts, started off on a 3,000-mile tour of inspection, covering the principal cities in the Eastern States and Canada. A special train of up-to-date sleeping cars had been placed at the disposal of the party, and this remained their headquarters during the twelve days' trip, most of the travelling from point to point being done during the night, leaving the days free for sightseeing.

The first city visited was Philadelphia, with its historic Hall of Independence meaning so much to the

*Because the Press was not allowed to be present at the discussions.

American nation. The party took tea in the Franklin Institute amid many interesting relics of the early days of electrical discovery. The Philadelphia Electric Co., whose chief engineer is Dr. L. Eglin, also president of the Franklin Institute, provided the entertainment for the guests, and this first day of the tour showed that there was to be some competition between the reception committees of the various towns to give the visitors the best possible time.

Washington, with its delightful lay-out and magnificent buildings, was reached at 7 a.m. on Saturday, April 24th, and for the short time available a full and interesting programme had been arranged. After visiting the Capitol and beautiful Library of Congress, the delegates were received by President Coolidge at the White House. The President shook hands with each delegate, and then kindly posed while the amateur photographer in the party "snapped" him.

Luncheon was provided at the Bureau of Standards, under the presidency of Dr. G. K. Burgess, and the afternoon was devoted to an inspection of the extensive laboratories. At the evening function, provided by the Washington Society of Engineers, the principal speaker was Mr. Hoovar, the State Secretary for Commerce.

Sunday, April 25th, was occupied in travelling by daylight through the remarkable Blue Ridge Mountains, along the River Potomac, and through Virginia and Maryland. This part of the country is full of historical associations of the French, Indian, and Civil Wars, and after an interesting journey the party arrived at Pittsburgh, the centre of the steel industry, to be welcomed by the local electrical representatives, under the chairmanship of Mr. T. P. Gaylor, of the Westinghouse Co.

On the Monday morning the party, after proceeding by river steamer to McKeesport, and thus having an excellent opportunity of viewing the vast industrial development of this important centre, lunched at the East Pittsburgh works of the Westinghouse Co., and afterwards inspected the hundred-acre factory. During luncheon the delegates were entertained by the KDKA orchestra, so famous in connection with transatlantic broadcasting.

Later in the day the party visited the Carnegie Institute, that magnificent centre of culture founded by Andrew Carnegie, the steel king, and after a dinner, presided over by Col. Samuel H. Church, rejoined the special train which was to convey them during the night to Chicago.

The competitive element in the entertaining was very clearly marked in the lavish and thoughtful reception accorded the Commission in this metropolis, which is the "beginning of the West." A wonderful programme of visits and entertainment had been arranged by the Commonwealth Edison Co., and when the day of sightseeing and speech-making was brought to a close, a daintily-conceived little surprise was sprung on the party. At the conclusion of an excellent musical comedy in the principal theatre in Chicago, an Indian chief came before the curtain and, in an admirable poem, welcomed the I.E.C. to his country, lauded its peace-making activities, and bade the party God-speed on its journey to other cities. The train left Chicago at 11 p.m. for Detroit.

The Ford works formed, of course, the principal venue in Detroit, and after admiring the working of that remarkable organisation and wondering possibly where such intense industrialism was leading humanity, the party was entertained by the Detroit Edison Co., saw its boulevards and power stations, and then moved across the river to Canada.

Niagara Falls was reached late the same evening, but not too late to prevent many of the delegates walking the few hundred yards to get a first glimpse of the swirling and tumbling waters in the moonlight before retiring. The Hydro-Electric Power Commission of Ontario and the Niagara Falls Power Co. combined to arrange an interesting programme of sightseeing and entertainment under the chairmanship of Mr. George S. Anderson. The various hydro-electric stations of international reputation were inspected, and the full beauty of the falls and gorge exhibited both by daylight and high-power flood lighting.

From Niagara the party moved on to Toronto, and after a short tour of the city it was entertained to dinner at the University, where the *bonne bouche* was a delightfully entertaining and witty speech made by Sir Wm. Muloch, K.C., the chief justice of Ontario. Leaving Toronto at midnight, Ottawa was reached early on Saturday, May 1st. There the Commission was received at the Parliament Buildings by the Speaker of the House of Commons of Canada, the Hon. Rodolphe Lemieux, K.C., LL.D. A pleasing little function followed, at which Dr. Semenza presented, on behalf of the visitors, a copy of the Head of Minerva. This was accepted by Dr. Barnes for the Canadian National Committee of the I.E.C. Several hydraulic plants of considerable interest and importance were inspected.

Sunday, May 2nd, was spent in Canada's commercial metropolis, Montreal—the morning in seeing and appreciating the natural beauties of this delightful city, and the afternoon in inspecting many interesting scientific and historical items in the McGill University. The work of Dr. Barnes, in his study of the ice in the St. Lawrence River, and the magnificent natural-colour photographs exhibited by him, were the cause of considerable comment.

During the night the party travelled to Boston, Mass., where a wonderful day was spent in visiting the Lynn works of the G.E. Co., the Massachusetts Institute of Technology, Harvard University, and the magnificently-equipped industrial Research Laboratory of the Simplex Cable Co. The Boston reception committee had a difficult task before it in entertaining the delegates so late in a tour on which so many wonderful things had been seen; but with its ample resources the difficulties melted. No day of the whole tour was so full of interest and kindly hospitality as the one spent in this city of Oliver Wendell Holmes and so many others whose names mean so much in American science and culture. The day so full of variety, entertainment, and instruction, was brought to a fitting close by an exhibition of a number of films, one showing the delegation arriving at Boston in the morning, and others illustrating the phenomenal rate of power development in the United States.

On Tuesday May 4th, the special train brought the party to its last objective, Schenectady, and the day was spent in a very complete inspection of the works and research laboratory of the General Electric Co. The entertainment was under the direction of Dr. E. W. Rice, and after a full day the delegates welcomed a night in a real bed. On the following morning the party moved off on the last stage of the tour, which consisted very suitably of a steamboat trip down the Hudson to New York. All agreed that this was a fitting finish to thirteen really strenuous days, and by the end of the week America had said good-bye to the European delegation, which was soon speeding eastward once more. Every one of the ninety delegates had the satisfaction of knowing that, as he returned to his own country and separated from this Electrical League of Nations, he had made many real friends, whose native tongue was not his own. The Conference had achieved great things in its official meetings, and by its personal contacts had done good work in cementing the engineers of the world into a common brotherhood.

Electricity in Farming.—According to the *Implement and Machinery Review*, about 90 farms are now using the Chester Corporation electricity supply for lighting, heating, cooking, ironing, vacuum cleaning, corn crushing, root cleaning and cutting, chaff-cutting, water pumping, wood sawing, and other tasks coming within the same category. Electric light in outbuildings has been found to expedite operations. Village craftsmen also make use of the same power, village institutions subscribe to the service, and in one village every house is using electricity. Even village streets and roads are illuminated by it. All this has been achieved without incurring a loss.

Hydroelectric Power on the Lower Isere.

The First Transmission in France at 120,000 Volts.

By T. RICH.

(*Concluded from page 798.*)

Transmission Line.

One of the reasons for the construction of the Basse-Isère station was the desire for an alternative and, so to speak, co-operating supply to the area round St. Etienne and Saint-Chaumond to work in connection with water power developed on the slopes of the central plateau.

A 60,000-V line, 93 miles long, to transmit 15,000 kW, was constructed before the war between the valley of the Romanche, near Grenoble, and St. Chaumond. Owing to the satisfactory results obtained with this line, and the increasing demands for power, it was decided to build the new station on the Isère. Part of the power supplied is used by the Loire et Centre Electrical Company and part by the Steel and Forge Company, of Homécourt, at Saint Chaumond. The supply was commenced in June, 1922.

From the station to Saint Etienne the length of the route is 43½ miles, and from the latter point to Saint Chaumond, a further 7½ miles. As the two companies purchasing power were connected with other water power interests with which it was desired to operate at times in parallel, it was decided to construct two separate transmission lines running parallel at a distance of 46 ft. apart, and arranged so that the two lines could be run separately or in parallel as desired; it was found that there would not be a great advantage from the point of view of first cost in running both lines on the same support, and that if this was done it would be much more difficult to obtain a safe and symmetrical arrangement of conductors. Moreover, the arrangement adopted allowed one line to be shut down when required.

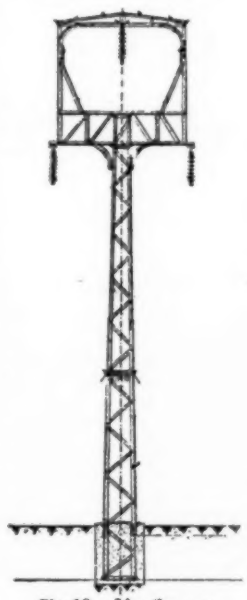

Fig. 10.—Line Support.

On the route to St. Etienne the line rises to 3,836 ft., and on the section on to Saint Chaumond 2,450 ft.; the line is double to the former place, where a 120,000/30,000-volt switching and sub-station exists, and single on to the latter, where the pressure is also reduced to 30,000 volts.

The line passes through several forests; where the line is double a clearance is made 50 yards wide, and with a single line 22 yards.

The supports for this line, which runs cross-country the whole way, are of a new type, fig. 10, patented by the Société Générale d'Entreprises, of Paris; it is designed so that the conductors can be placed in an equilateral triangle, an arrangement which minimises disturbances on neighbouring telephone and telegraph lines and reduces tendencies to surges. The bending moment about the base is reduced, as compared with supports with one conductor on one side and two on the other. The three conductors are suspended in three well-spaced vertical planes (8.3 ft.), which minimises the danger of short circuit when a sudden fall of snow from a conductor gives rise to a whipping motion. At first sight one would think that the enclosure of the top conductor inside a steel frame support would give rise to electromagnetic losses, but tests carried out on the line have shown no trace of the existence of such losses.

On normal line supports the top conductor is suspended at a height of 56.4 ft., the two lower at 42 ft. At the base the four angles of the upright are placed 3 ft. 7 in. apart; the angle steel is $2.75 \times 2.75 \times .275$ inches, with the top half angles $2.36 \times 2.36 \times .23$ inches.

The total height is 51 ft. 11in., of which 6 ft. 6¾ in. is in the ground. The total weight of each support is 1.360 kg., or nearly 27 cwt.

The terminal posts are designed to resist a breakage of the three conductors; they are similar in type to the others, but are stiffened up and weigh 2.185 kg., or 43 cwt. In the district where the line passes over high ground, where great difficulty was foreseen from the formation of ice on the conductors, the supports are still further strengthened; they weigh 3.205 kg., or about 63 cwt.

When crossing railways or telephone lines, angle brackets, fig. 7 (p. 797), are fitted projecting in the direction of the conductors, so that if a conductor broke it would be earthed at once.

Fig. 11.—Installing Suspension Insulators.

For the crossing of the River Rhone with a span of 245 metres (268 yards), the three conductors are arranged in a horizontal line; they are supported at a height of 24 metres above the ground. The supports in this case weigh 8½ tons each. The foundations were protected to resist the action of floods.

Insulators.

The Société Générale d'Entreprises, the contractors responsible for the design and construction of the line, chose insulators of the Hewlett type; they have the high breaking strength of 6 tons, and in case of breakage of an insulator they do not let the conductor down. With single suspension seven insulators are used, double suspension being used for the crossing of railways; for telephones and power lines, seven or eight

insulators are used; and for the Rhone crossing two sets of eight insulators in parallel. Fig. 11 illustrates the fixing of the insulators.

Conductors.

The conductors are of aluminium steel, and each has seven wires, 4.31 mm. diameter (about No. 7 s.w.g.), of total diameter 13 mm. (0.511 inch). The breaking strength is 2.65 English tons; weight 364 kg. per km., or 1,290 lb. per mile. In the upland district, where intense precipitation takes place owing to the peculiar conditions of ice, cold, and fog which exist at times, and where it has been found that ice can form round the cable, making a sleeve nearly 4 inches in diameter, a cable is used of 37 conductors and 15.8 mm. total diameter (.62 inch), with a total weight of 570 kg. per km., or 2,020 lb. per mile, with breaking strain of 4.18 tons. On this section the spans were limited to 80 metres, with a drop of 4.5 metres at 45 deg. C. The conductors are in an equilateral triangle 5.08 metres a side, about 16 ft. 8 in. apart; this allows of ample oscillation for the conductor. The earth wires are of galvanised steel of 50 sq. mm. section; they are attached to one of the top corners of the supports and fixed by means of a clip. The normal spans are 140 metres (153 yards); in special positions spans up to 220 metres have been adopted.

Four section stations are installed along the line so that, by means of links, any section of the line can be cut out for the repair of any damage, and further various combinations of conductors can be used. At each section station the conductors are rotated in position, and to avoid mistakes, the posts of one through line are marked with odd numbers, and the other with even. For the construction of the line, owing to the absence of railway communication on the route followed, extensive use was made of motor lorries for the transport of the necessary materials, the line supports being carried with the aid of two-wheeled trailers.

Experience since 1922 has shown that the precautions taken in the region where ice-cold fogs were prevalent were by no means excessive, and that the adoption of short spans for such sections and conductors of special breaking capacity was justified; in fact, at some particular points a deposit of ice 20 cm. (7.8 in.) thick has been experienced.

The engineers of the power company realise that, owing to the study of conditions ruling in each section of the work, it has been possible to design the line accordingly. At some points, under severe conditions of irregular strain due to ice deposits, the supports have shown signs of bending, but as the elastic limits were not exceeded, they recovered on the removal of the strain. Up to now, apart from wilful damage from gun-shot or the throwing of stones, the insulators have given no trouble, and despite extraordinarily difficult conditions, there has been no interruption in the service. The work at the power station and on the line strikes one as being of a high-class character.

Thanks must be given to the Basse Isère Company, and especially to the resident director, for information and illustrations, and thanks are due to the several contractors mentioned in the text for assistance and for the photographs used in the preparation of these notes.

Municipal or Company Trading.

Its Bearing on the Electricity Scheme.

By F. PEAKE SEXTON, A.R.C.S., A.M.I.E.E., Member Institute of Engineering Inspection.

THE question of municipal *versus* private trading is to-day one of the most talked-of problems, and new facts, or even old facts presented in a new way, are likely to be both interesting and instructive. It is for this reason that the writer is presenting some data obtained primarily for a consideration of the new electricity scheme. It is, of course, admitted that even many opponents of municipal or rate-aided trading are prepared to allow that electricity supply forms a very fitting outlet for municipal activities, and the justice of this should be evident from the information here presented. Talking of "Rate-aided trading," the question arises, why not "Trade-aided rates!"—a phrase which the writer has never heard, it being generally left to an assumption that the trading is not successful. It is not fair to bias the mind in one direction before the facts are adjudged, although this is the usual method of dealing with a problem of a political nature, where in general the cry is "party," be it right or be it wrong. Nevertheless, the question is here brought forward in the scientific spirit, where the only party is the community, the right solution being the greatest good to the greatest number.

The word "community" is not to be taken as in any way connected with Communists, a body that has adapted a useful word to a special code of politics. Let the reader carefully consider this policy before reading further, and bear in mind that it is non-party, neither Conservative, Liberal, nor Labour.

The working costs of various supply stations are tabulated in Table I in accordance with the capacity of the plant installed, the municipal- and company-owned stations being separated. The charges for repayment of loans are very severe on municipal undertakings, and although companies do allow for depreciation, it is often inadequate; on the other hand, the municipal repayment is a handicap to municipal cheap production, but at the same time it is commercially a very sound policy.

The figures given are all for public supplies of electricity, and all stations are included for which returns are available.

TABLE I.

Mean size of plant in kilowatts.	Total cost of generation per unit, in pence. Municipal.	Company.
250	3.31	5.18
750	2.43	3.06
1,500	2.23	2.11
3,000	1.62	1.90
6,000	1.48	1.99
11,500	1.07	2.41
22,500	0.97	0.80*
45,000	0.81	1.27
90,000	0.62	0.98*

*These returns are based on only one station in each case.

Column 1 gives the average capacity of the station; 2, the average cost of municipal production; and column 3 the corresponding figure for company generation.

The cost of generation is affected by local conditions, nature of the plant, and the load factor among other matters, but as these figures are in most cases the mean of many stations, the costs are really comparable.

The results are not what the writer expected, as he anticipated for company stations a lower cost of generation with a higher profit per unit sold. Yet with only two exceptions the costs are higher, and in one of these cases there is only one station in the returns of com-

pany workings from which the average is obtained. In these cases it is only fair to point out that local conditions may have made the costs low, and in some cases the stations are partly buying in bulk and thereby confusing the costs. On the whole, this should lay to rest those tales of municipal waste and extravagance.

Turn now to Table II, where the profit per unit sold is shown both for the municipal and company undertakings cited in Table I.

TABLE II.

Mean size of plant in kilowatts.	Profit charged per unit. Municipal.	Company.
250	2.12	3.06
750	1.77	3.15
1,500	1.84	2.03
3,000	1.27	2.08
6,000	1.15	1.80
11,500	0.87	2.66
22,500	0.79	0.77*
45,000	0.75	1.40
90,000	0.70	0.58*

*These returns are based on only one station.

Here is shown the much higher profit demanded by the company than the municipal stations, specially in the smaller ones. In fact, in only two instances is the profit less in the case of companies, and here it is only fair to mention that the figures refer to one station in each case, and not an average. In the case of stations of about 750 kilowatts, the excess charged by the company stations is 1.38d. per unit, or nearly 80 per cent.; and, again, in the case of the 45,000-kilowatt stations the results are similar.

The figures given above are in all cases averages, and as the judgment of the results must depend on the number of stations considered, Table III gives the number of stations from which the two previous tables were obtained.

TABLE III.

Mean size of plant in kilowatts.	Total number of stations. Municipal.	Company.
250	12	47
750	17	26
1,500	32	3
3,000	25	8
6,000	37	4
11,500	29	2
22,500	28	1
45,000	12	5
90,000	5	1

These figures show that for the 250-kW stations there are four company undertakings to every municipal one, whereas in the case of 90,000-kW stations the figures are reversed. Very many of the small stations are subcompanies of some large Corporation, a fact that should tend to economy, but which nevertheless has not brought the cost down.

A careful consideration of these figures must result in an agreement that the municipal stations are able to produce electricity at a lower rate, and are willing to sell it at a lower profit, than the company stations.

In conclusion, it may be pointed out that although the advantages of municipal stations have been shown, this does not give support to the Government electricity scheme, as Table I shows that there is little difference between the "super" and the large stations. In some individual cases, smaller stations are producing at lower rates than the super-stations, so one might suggest the suitable selection of the station rather than size, but it appears that the latter is the main factor in the scheme now before Parliament.

On Applying for a Job.

By "JUDEX."

IT has been my lot on many occasions during the last 20 years to sift out applications for advertised engineering posts, to recommend names for a "short leet," and (either alone, or as a member of a selection committee) to interview candidates and make the final choice. None of these things are easy. Some applicants, who would perhaps suit admirably, never get a chance because they do not know how to apply; others, palpably useless when seen, get selected for interview because they have the knack of stating their cases well; between are those who are interviewed, perhaps, for no other reason than a scarcity of candidates, and then turn out to be men of character and ability beyond what their papers would lead one to expect.

It may cost a shilling or two to get an application typed on good paper. Perhaps one ought not to be prejudiced by such a detail, but attention to it shows an orderly mind in the applicant and ensures legibility. For copies of testimonials, either printing or type should be the invariable rule, for no one will willingly wade through hand-written copies. Nevertheless a sample of handwriting should be worked in, preferably in a covering letter to the formal application; since, whether there is anything in graphology or not, most judges of character are in fact influenced by it. A man who cannot keep his lines straight is not likely to be neat in other respects; one who finishes his letter at the side or the top to save a sheet gives a glimpse into his mind. Among a batch of applications are generally some in which the grammar or spelling shows defects of general education which may be fatal for superior posts abroad, especially among natives; for the brown and yellow races are quick to recognise the mechanic who is not a "sahib" but is in a sahib's job. Avoidance of such errors may lead to the "short leet," but a minute's interview will, of course, prove if the candidate will do or not.

If the applicant's nationality is asked it is prejudicial to say "British subject" if in fact the man is also a Maltese or a Eurasian or a Hottentot. To omit to give a father's profession when it is asked for is a tactical error; many a shopkeeper's or drummer's son is a public school man and a first-rate engineer.

In recent years I have noticed that not 1 per cent. of those to whom it applies use the term "chartered (civil or electrical) engineer." Also, those with war service omit to state in what branch of the services they were or in what countries they served. Good war service, other things being more or less equal, is a qualification in itself, at least for the public service.

Young Indians, who go to America and come to England in increasing numbers for training, almost invariably concentrate on a sheaf of personal testimonials to character from their relations and friends who have attained high office; they also frequently apply for an immediate interview, in the hopes of getting a bulge on their competitors. Their experience at 25 is so vast that it is hard to understand why they are not in departmental charge at Schenectady or Trafford Park. One such, having been pitchforked into an assistant's job in a railway workshop, was told (after a week or two) to start up the plant next morning. After an hour's delay his chief had to come and do it; for the young genius *could* not and his subordinates *would* not.

For the men selected for interview I have much sympathy; it is a trying business, especially to a man of 30 or more, to have to answer technical conundrums offhand with three or four grey-beards staring at him.

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But here are some questions which chartered electrical engineers have failed over:—

(1) What is the full charging voltage of a secondary cell? (Answers from 1.8 to 2.2 from several.)

(2) What will be the approximate fuel consumption of a 500-kW direct-connected Diesel set and the steam consumption of a similar turbine set, per kWh? (Several had no idea at all and had the sense to say so; others, in the same box, guessed—a foolish thing to do).

(3) What methods can be adopted for preventing the high-tension side of a transformer getting into the low-tension circuits? ("Fuses," said one.)

(4) Mention any methods of rendering an overhead line "dead" if it should break? (This stumped most, including a technical college lecturer.)

(5) How is the pressure drop over a rail joint determined?

(6) Distinguish between a motor-generator, motor-converter and rotary converter.

Not much weight, however, need be given to the ability to reply correctly to a *viva voce* examination. What the examiners are after is to see how the candidate behaves; whether he can look you straight in the face and show character and decision there; whether he can say: "I'm sorry, but I can't answer that offhand"; whether he tries to evade plain non-technical questions that are awkward.

One engineer, now very well known at home, obtained his second job and his real start in life by adding three years to his age, on my very immoral suggestion; I expect he is still saddled with those years, and would be glad to get rid of them. On the other hand, the best of a batch I was once interviewing had taken several years off his age, to get within the advertised limit. After some general conversation, when he was off his guard, I said, "Let's see, you are 29, are you not?" He went scarlet, and without more ado admitted the deception. He got the job and left it for a better within six months.

Perhaps the most extraordinary change in the whole matter is the attitude to degrees and diplomas. When I started life a man with a B.Sc. or the like had to keep quiet about it, for fear of being thought a something else also. Now it is an essential qualification for many posts that the applicant shall either have a degree in engineering or science or that he shall have become an A.M.I.E.E. by examination. The war concession in this matter is a little awkward at times.

The Association of Municipal Electrical Engineers (South Africa).

(From Our Special Correspondent.)

THE seventh Convention of the Association of Municipal Electrical Engineers (S.A.) was held in Johannesburg during the week April 12th to 16th, and was largely attended by members and delegates from various parts of the Union.

The first day was devoted to the business meeting, at which the retiring president, Mr. John Roberts, borough electrical engineer of Durban, presented his retiring address.

Mr. B. Sankey, general manager of the Johannesburg gas and electrical undertaking, was elected president for the ensuing year, while Mr. J. Mordy Lambe, city electrical engineer of East London, was elected vice-president, the members of the Council being elected as follows:—Mr. T. C. Wolley Dod, Pretoria; Mr. G. H. Swingler, Cape Town; Mr. John Roberts, Durban, past president; Mr. L. F. Bickell, Port Elizabeth; Mr. T. Millar, Harrismith; and Mr. E. Poole, Durban, with Mr. R. G. Tresise as honorary secretary and treasurer.

It was resolved that the next Convention be held at East London. During the week many interesting visits to works were made, and papers were read by the following:—

"Presidential Address."—Mr. B. Sankey, Johannesburg.

"Alternating Current Sub-Stations and their Equipment for Urban Areas."—Messrs. A. T. Rodwell and P. Fraser, Johannesburg.

"The Merits of Suction Gas Engines as Prime Movers in Municipal Power Stations."—Mr. H. M. S. Muller, Beaufort West.

"Discussion on Licensing of Electricians." — Introduced by the President.

Members and Delegates of the Association of Municipal Electrical Engineers (South Africa) at the Convention held in Johannesburg.

(2nd Row).

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E. POOLE, Durban (Member of Council).
T. C. WOLLEY DOD, Pretoria (Member of Council).
J. MORDY LAMBE, East London (Vice-President).
B. SANKEY, Johannesburg (President).
G. H. SWINGLER, Cape Town (Past President).
L. F. BICKELL, Port Elizabeth (Member of Council).
R. G. TRESISE, Johannesburg (Hon. Sec. & Treas.)

A joint meeting of the Association and the South African Institution of Electrical Engineers was also held, at which a paper on "Electric Light and Power Schemes for Moderate-sized Towns in South Africa" was read by Mr. R. F. Botting.

The visits included an inspection of the Johannesburg municipal power station, workshops, and distribution system; the steel works of the Union Corporation of South Africa, Ltd.; the works of the Vereeniging Brick & Tile Co.; the Rand Water Board's pumping station; the Rosherville station of the Victoria Falls and Transvaal Power Co., Ltd.; and the Pretoria power station and Royal Mint.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Conserving Our Coal.—In order to conserve our dwindling stocks of coal, an order was made last week by the Mines Department restricting domestic supplies to 1 cwt. a fortnight obtainable only by the written permission of the local authority or its duly authorised officer. Householders were asked to exercise the utmost economy in the use of electricity and gas. In the case of industries, businesses and establishments, the consumption of coal is to be restricted to one half of the normal, unless a special case can be made out to the satisfaction of the local authority. This applies also to the consumption of gas and electricity. The order banned absolutely all lights used solely for display and advertisement, except where they are necessary for the public safety.

Glasgow Corporation and Tramway Strikers.—At a meeting of the Glasgow Corporation on May 27th, Mr. T. A. Kerr, the leader of the Labour group, moved the suspension of the standing orders to enable him to bring forward a resolution instructing the tramway manager to reinstate all employés who ceased work during the general strike. The suspension was refused by a majority, and the Labour members then prevented further proceedings and the meeting was adjourned for a fortnight.

A Useful Demonstration Device.—The *Electrical World* recently made mention of a demonstration device employed by the Alabama Power Co. in one of its show windows. It consists of a board to which are plugged six devices—a bowl fire, a vacuum cleaner, an iron, a percolator, a churn and a small table stove. An electric fan motor operates a contactor device which puts each appliance into circuit in turn for about six seconds. In the centre of the board is an indicating wattmeter calibrated in cents per hour based on the company's rates for energy, and this shows the actual cost of operating each appliance.

The Australian Duty on Radio Valves.—The *Board of Trade Journal* states that the operation of the Australian import duty on valves for radio-telegraphy and telephony has been deferred until July 1st.

Lead.—Messrs. James Forster & Co., reporting on May 29th, stated:—"Prices during the week have been practically stationary. Consumption has again received a check in this country, consumers being restricted to 50 per cent. of their normal fuel supply. This in turn means a smaller demand for lead. In Germany, on the other hand, consumption is improving and a shortage of lead has developed, with the result that orders are being placed in London for prompt shipment. This had the effect of relieving the pressure of supplies here. . . . The future of the market is obscure, so much depending upon whether the coal dispute is settled quickly or not. A restriction of consumption in this country to 50 per cent. of the normal would be bound to be felt if continued for long, but on the other hand, an early settlement would mean a good demand from home consumers for prompt lead and would probably result in a shortage of ex ship lead and a consequent advance in price. The Board of Trade returns for April are:—Imports 30,652 tons, exports 1,946 tons, leaving for home consumption 28,706 tons."

New Indian Companies.—Among the electricity undertakings recently organised in India are the Narayanganj Electricity Supply Co., formed at Armenitola (106 Kaliprasanna Ghose St.) Dacca, Bengal, with a capital of 500,000 rupees, and the Rangpur Electricity Supply Association, organised at Rangpur (Bengal) with a capital of 100,000 rupees.

Dublin Contractors' Meeting.—The *Irish Electrician* reports that the Dublin branch of the Electrical Contractors' Association held its first annual meeting on May 10th, when the chairman, Mr. A. G. Bruty, gave a *résumé* of the work accomplished during the year, including the formation of a joint committee with wholesalers and factors for the discussion of matters of trade interest. Real progress had been made towards a policy advantageous to all interests. Amongst various matters dealt with, the Dublin Commissioners had been seen concerning the proposed drastic restrictions on the erection of electrical signs, and the city engineer concerning fixing tariffs for electric cookers. Membership had increased considerably. Mr. Bruty was appointed chairman, and Mr. A. J. Orr was elected to the committee.

N.S.W. Preference Proposals.—The Premier of New South Wales (Mr. Lang) recently announced that the State Government had decided that in respect of its orders it would grant a preference of 30 per cent. to locally-manufactured articles over foreign goods, and one of 20 per cent. over British goods. The preferences would be inclusive of Commonwealth tariff duties and preferences already in existence. The preference over British goods would diminish according to the amount of duty already imposed upon them. For instance, where a 10 per cent. preference already existed, the State's preference would be reduced to 10 per cent. The Sydney *Daily Guardian* considers that these preferences mean practically nothing to local industries as the principal items required by the Government are already given more than 20 per cent. preference over British goods by the Commonwealth tariff. This journal quotes electrical fittings (35 per cent.) and electrical machinery (40 per cent.) among other examples.

Wages in the Engineering Industry.—The engineering trade unions intend to proceed with their applications for increased wages by districts, the demand for a national increase having been unsuccessful. A conference is to be held at York on June 11th, when it is expected that those districts which have not yet put forward applications will do so. Although it is understood that there was a majority in favour of a strike in the London area, further action has been deferred.

German Turbines for Russia.—An *Exchange Telegraph* message from Berlin states that despite keen English competition, a Russian order for three turbines valued at £40,000 has been secured by the Allgemeine Elektrizitaets Gesellschaft.

Employment During April.—The May *Ministry of Labour Gazette* says that employment in the engineering industry during April, though still bad on the whole, showed a further improvement. In the electrical section it remained fair, although it showed a slight decline as compared with April, 1925. The general engineering percentage of unemployed was 10.4, while in the electrical section the proportion was 6.6 per cent. as compared with 6.7 per cent. in March and 5.6 per cent. in April last year. In both comparisons unemployment in the electrical wiring and contracting industry showed an increase, being 8.6 per cent. On the other hand, unemployment was lower in the electrical cable, wire and electric lamp manufacturing group, at 6.5 per cent.; this figure compared with 8.5 per cent. in April, 1925.

Carrying on During the Strike.—Electrical manufacturing companies took every measure in their power to continue operations during the general strike. The Automatic Telephone Mfg. Co., Ltd., found itself at the outset with a depleted staff of toolmakers, sheet metal workers, cabinet makers and other "key" men, but by a reorganisation a temporary balance was maintained to keep the various departments working and prevent 94 per cent. of the staff from being thrown out of work. Two of the company's delivery vans were put into service as temporary "'buses" to enable the staff to get to and from their homes.

"Exide" Batteries at the Pole.—Another example of the reliability of "Exide" batteries under strenuous conditions is demonstrated by the fact that the airship *Norge* was equipped with these batteries for radio and other purposes during her eventful trip over the North Pole. The Byrd and Wilkins expeditions also used "Exide" batteries.

Chilean Commercial Secretary's Address.—As from June 5th the address of Mr. W. F. Vaughan Scott, the Commercial Secretary for Chile, will be 66, Calle Teatinos, Santiago.

The National Radio Exhibition.—We have received from the National Association of Radio Manufacturers and Traders full details of the arrangements for the National Radio Exhibition which is to be held in the New Hall, Olympia, from September 4th to 18th next. The Association states that although the space contract will be with itself (as being the only body properly constituted to enter such a contract) the promoters are the Radio Manufacturers of Great Britain—members of the N.A.R.M.A.T. and of the Society of Radio Manufacturers. The allocation of space will be made by ballot in the case of firms whose applications are received by June 14th; thereafter the allotment will be at the discretion of the organisers. The regulations for the Exhibition contain a number of matters of interest. In the first place, there is nothing in them to indicate that the Exhibition is confined to members of the two associations mentioned; it can be assumed, therefore, that any maker or distributor of radio apparatus can enter, subject to the proviso that all exhibits and component parts thereof must be of British manufacture, *i.e.*, made in Great Britain or Northern Ireland. No "listening" or loud speaker demonstrations by exhibitors will be permitted, nor any electric signs or other apparatus capable of causing interference. No exhibitor may give, or assist or support the giving of, any public demonstration within a quarter of a mile of the Exhibition. Publicity matter issued from the stands is to be subject to the Exhibition Committee's approval and must only deal with actual exhibits. Each exhibitor is required to provide a fire extinguisher for his stand. The organisers have made arrangements with the British Broadcasting Co., Ltd., for the reproduction of its programmes, and the Royal Air Force band has been engaged for the run of the Exhibition.

A Handicap to Australian Electrical Development.—Giving evidence recently before the South Australian Royal Commission on Manufactures and Secondary Industries, Sir John Monash, chairman of the Victorian Electricity Commission, said that Victoria was poorly industrialised, in spite of cheap power, on account of the high tariffs on imported articles. He maintained that the heavy duties on electricity consuming devices, such as radiators, fans, stoves, &c., should be removed. In that matter the interests of the community at large were in direct conflict with those of the manufacturers.

Sales Conference.—Representatives of Philips Lamps, Ltd., from all over the country recently came together in conference to discuss the policy for the coming lighting season. On the second and concluding day of the conference a dance was held at the Wellington Hall, St. John's Wood, and the event proved very successful.

New Canadian Works.—New works for the manufacture of secondary batteries for motor car, radio and marine use, have lately been completed in Kingston, Ont., by the Monarch Battery Co., Ltd.

The Timber Market.—Our timber trade correspondent reports that the heavy stocks of building and general utility woods in the country, so noticeable at the end of the first quarter of the year, were supplemented by increased quantities imported in April. The consumption throughout the first four months of the year, however, was good, which kept the stock position at a fair volume. The general stoppage of trade during the early days of May was the means of restricting large supplies going into consumption, but this condition should be levelled off by the expected greater demand in the early future, and particularly when the coal dispute is ended. The hardwood trade on the whole cannot be described as strong. Imports of mahogany have increased, especially of the lower grades, which require much effort to sell from first hands, although good qualities keep firm in value. Sawn hardwoods from the United States, principally oak, arrived more freely last month compared with a year ago; these were not wanted, considering the large stocks already held before their arrival. In hard and fancy woods generally the demand is usually limited, but the call at present is very much restricted. The poor grades, both as regards quality and size, are hard to sell from first hands, but good logs command full figures.

Trade Announcements.—MESSRS. MANDA MOTORS, LTD., of Royal Mint Street, E.C., who commenced manufacturing operations in March last year, are taking additional factory accommodation. They have been placed on the Admiralty list.

The head offices of the SCOTT INSULATED WIRE CO., LTD., have now been removed to their new premises at 44, Queensland Road, Holloway, N.7. Their new telephone number is North 1707 (not 1706, as given in our issue of May 7th).

MESSRS. PRITCHETT & GOLD and E.P.S. Co., LTD., state that they are despatching as quickly as possible all orders which were held up by the strike consequent upon the difficulty experienced in moving goods either from the works at Dagenham Dock or from the Pimlico Road depôt.

MESSRS. MEDWAY'S SAFETY LIFT CO., LTD., have appointed Messrs. Fairclough & Co., Ltd., 11, New Station Street, Leeds (Telephone No. " Leeds 21105 "), as their agents for the Leeds district.

The PHŒNIX ELECTRICAL CO., LTD., has removed to 18, Scotland Street, Glasgow. 'Phone No.: " South 2011."

MESSRS. JAMES GORDON & CO., LTD., report a record month in the sale of Cope's feed-water regulators, 50 sets having been ordered during May for super power stations.

Mr. E. A. PINTO has transferred his Margate and Hythe businesses to his head office at 96, High Street, Ramsgate, to which address all communications should be sent.

Catalogues and Lists.—MESSRS. D. H. BONNELLA & SON, LTD., 46 and 48, Osnaburgh Street, N.W.1.—A well-illustrated, priced catalogue of automobile accessories, including lighting fittings, fans, cigar lighters, flower vases, &c.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—A booklet dealing with the design of electric motors, written for users.

MESSRS. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester.—Catalogue Section No. 30 B1, illustrating and describing oil-immersed circuit breakers for outdoor service at pressures ranging from 11,000 V to 135,000 V and of various rupturing capacities.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 and 39, Upper Thames Street, E.C.4.—A priced and illustrated list (No. 151) of " Siemens " electric fans of various patterns.

MESSRS. NEWTON BROS. (DERBY), LTD., Alfreton Road, Derby.—A catalogue containing illustrations and full particulars of the company's induction motors ranging in capacity from 3 to 240 h.p.

MESSRS. W. WADSWORTH & SONS, LTD., Bolton.—A well-produced brochure, illustrated with half-tone and coloured reproductions, describing the firm's electric lifts in very full detail.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—" The Benjamin Reflector " for May-June, containing illumination data and particulars of " R-L-M " reflectors.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A priced and illustrated sheet advertising the " Supreme " fan and " Universal " toasters, table cookers, &c. Also folders dealing with an electric floor polisher, which can be hired, and the " Universal " electric curling iron.

" Z " ELECTRIC LAMP & SUPPLIES CO., LTD., 73, Newman Street, W.1.—A price list of " Cosmos " electric fans.

THE S.G. BRILL COMPANY, Aldwych House, Aldwych, W.C.2.—A wall-chart bearing illustrations of " Brill " tramcar parts and a pad of order slips.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, W.C.2.—A series of illustrated pamphlets dealing with the " Sunshine " vacuum cleaner, lightning arresters for radio sets, electric floor polishers, electric sterilisers, violet-ray apparatus, &c.

STANDARD TELEPHONES & CABLES, LTD., Bush House, Aldwych, W.C.2.—A handsome brochure containing an illustrated description of the installation of the company's " Public Address " system in the new Liverpool Cathedral.

MESSRS. NEGRETTI & ZAMBRA, LTD., 38, Holborn Viaduct, E.C.1.—List No. T6, containing particulars of the company's electrical thermometers and pyrometers.

THE IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publications Nos. 6216 and 6219, dealing, respectively, with a " Universal " coil holder, and a tone control and damping resistance. Illustrated and priced.

MR. J. R. MORRIS, 15-19, Kingsway, W.C.2.—A priced and illustrated pamphlet advertising " Columbia " dry batteries for radio work.

SIEMENS BROS & CO., LTD., Woolwich, S.E.18.—Price Sheet 641, containing full details of the company's dry batteries for all purposes.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A showcard advertising the company's automobile lamps and Leaflet No. 74, dealing with Philips rectifiers for automobile and radio batteries.

Bankruptcy Proceedings.—STEPHEN PAGE, Carholme Road; FRANK LEECH, Breadgate, both Lincoln; and HENRY HUDSON, Shrewsbury Road, Sneinton, Notts., trading in co-partnership as the East Midland Engineering Co., Lincoln, engineers. The following are creditors herein :—

	£		£
Edison Swan Electric Co., Ltd.	186	Clegg, Stanley	101
Dawson's Electric Co.	91	Crampton & Co., Ltd.	34
Howard, G. A.	45	Tucker, J. H., & Co., Ltd. ...	22
Chloride Electrical Storage Co., Ltd.	52	Lincoln Corporation	22
Shipley & Co., Ltd.	27	Bright, J. & A., J. B. Anderson, Mellers, Basden & Mellers,	
Fyfe, Douglas	42	Darbyshire & Co.	80
Croft, Alice	55		

W. H. GREENALL, trading as the Hampton Electric Co., Newerne Street, Lydney, Glos., electrician.—The first meeting of creditors was held on May 26th at Cardiff. The statement of affairs showed liabilities of £472 and assets of £65, leaving a deficiency of £407. Debtor attributed his failure to losses on contracts. The case being a summary one, was left in the hands of the Official Receiver as trustee.

F. J. NORTH, electrical engineer, 13a, Midland Road, Wellingborough.—Trustee, Mr. D. Helliar, The Parade, Nottingham, released May 18th.

S. J. WATSON, lately carrying on business with H. Rothwell and F. C. Jinks as the Vulco Magneto Co., 11, Long Acre, W.C.—Last day for proofs for dividend, June 12th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

J. WORSLEY, electrician, 10, Green Street, Darwen.—First and final dividend of 5s. 7d. in the £, payable June 11th, at the Official Receiver's offices, 11, Winckley Square, Preston.

Company Liquidations.—C. A. C. RADIO, LTD., 10, Rangoon Street, E.C.3, and at Bournemouth and Leeds.—A meeting of creditors was held on May 21st at Winchester House, E.C., when the chair was occupied by Mr. E. W. Sudlow, C.A., Ilford, Essex, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. No statement of affairs was presented, but it was reported that the liabilities amounted to £14,600, and that there was a deficiency of £6,148. The issued share capital of the company was £19,500, so that the total deficiency was £25,648. The liquidator stated that at two previous meetings of the creditors it was thought that a scheme might be put forward whereby the company would be able to carry on. That scheme, however, did not materialise and eventually resolutions were passed for voluntary liquidation. The liquidator added that since he had been appointed he had found very serious discrepancies between the figures given at the first meeting and those which were now before the creditors and that had full information been given at the time there would have been no possibility of any scheme being formulated. A resolution was passed to the effect that application should be made to the Court for the appointment of Mr. J. W. Galloway to act as joint liquidator with Mr. Sudlow.

SHENTON & CO., LTD., wireless and electrical engineers, 68, Shoe Lane, E.C.—A meeting of creditors was held on May 26th at the offices of Messrs Poppleton, Appleby & Hawkins, Charterhouse Square, E.C., when the chair was taken by Mr. E. H. Hawkins, who had been appointed to act as joint liquidator with Mr. W. B. Pearson, John Street, W.C. The statement of affairs submitted disclosed liabilities of £4,700, and the assets, after allowing £3,600 for debentures, totalled £2,550, leaving a deficiency of £2,150. Mr. Hawkins reported that the company was registered in January, 1922, as a private company with a nominal capital of £4,000, of which 3,000 shares were issued as fully paid to a Col. Handley as purchase price for a business which Col. Handley had bought from the receiver of the company then known as F. J. Shenton & Co., Ltd. Various accounts had been prepared showing a series of net losses. The liquidator said that from time to time the company borrowed money from its bankers on the guarantee of Col. Handley and from the Electrical Trades Supply Co. The company was pressed for repayment of the loans and made strenuous efforts to obtain further capital from another source, and after considerable negotiations a Mr. E. H. Tubbs found £3,500, of which £1,000 was paid to the bank, and £1,500 was utilised to satisfy the claim of the Electrical Trades Supply Co., leaving £1,000, which was used as working capital. To secure the loan the company created debentures up to £4,000 at 7½ per cent. interest, of which £3,500 worth were issued to Mr. Tubbs. Col. Handley then resigned from the board and transferred his shares to Mr. Tubbs and a Mr. W. Nicholson was also appointed a director. At a later date Mr. Tubbs resigned his position as a director and on February 25th last, in order to protect the assets against seizure by the sheriff, he appointed Mr. Pearson as receiver. Mr. Pearson cut down the working expenses of the business to a considerable extent and had paid £1,100 off the debentures. The meeting broke up without any resolution being passed, but an advisory committee was appointed, consisting of Mr. Adams, representing the

Siemens & English Electric Lamp Co., Ltd., Mr. W. A. J. Osborne, representing creditors, and Mr. E. Judd, of Corfield's Traders' Association, representing the "Z" Electric Lamp and Supplies Co. The following are creditors:—

	£		£
Accumulators (Birmingham), Ltd.	69	Igranic Electric Co., Ltd. ...	56
British Thomson-Houston Co., Ltd.	121	Kohler, A., & Co. (Germany) ...	41
Byron, C. H., & Co.	38	Kromberg & Schubert (Barmen)	83
Bedford Electric & Radio Co., Ltd.	154	Hehne, J. G. (Germany) ...	32
Birmingham Mailing Cases, Ltd.	33	Mullard Radio Valve Co., Ltd.	80
Brandes, Ltd.	32	Marconiphone Co., Ltd.	46
Chasseral (Switzerland)	74	Newberger, J. (Germany) ...	139
Davies, Kent & Stewart	32	Portable Utilities Co.	31
Elfflander, T. (Berlin)	229	Reeves & Co.	84
Nenn Werke (Nürnberg) ...	145	S.D.H. Manufacturing Co., Ltd.	89
Fonteyn, Gilbert & Co., Ltd. ...	35	Siemens & English Electric Lamp Co., Ltd.	333
Formo Co.	32	Trent Electric Wire Works, Ltd.	39
Grother & Sohne (Germany) ...	123	Tubbs, E. H.	400
General Electric Co., Ltd. ...	81	Tant & Co., Ltd.	32
Grau, Hermann (Germany) ...	32	Wooding & Co.	43
Hough, J. E., Ltd.	55	"Z" Electric Lamp & Supplies Co., Ltd.	133

BURWOOD (CONCESSIONAIRES), LTD., wireless and electrical manufacturers, Great Queen Street, W.C.—A meeting of creditors was held on May 26th, at the offices of the Society of Incorporated Accountants and Auditors, E.C., when a statement of affairs was presented, showing liabilities of £1,679, all due to unsecured creditors. There were debentures and interest amounting to £517. The net assets were £213, leaving a deficiency as regarded the creditors of £1,466, and a total deficiency of £2,466. The liquidator reported that the company was registered in July 1925, with a nominal capital of £1,000 in £1 shares, and took over the business originally carried on under the style of the Burwood Electric Supply Co. The total purchase price was £1,308. On January 22nd last a debenture was registered for £500, to Mr. J. H. Wood, for a cash consideration. Branches were opened at Manchester, Dublin and Brighton. None of those branch shops had done an extensive business, and apparently losses were incurred throughout. The present position was attributed mainly to a trade protection agency putting the company on its "black list." In reply to questions, the liquidator said that if there were any books he had not been able to obtain them. He was unable to state who the vendor was or who were the partners of the Burwood Electric Supply Co. Mr. J. H. Wood (the managing director) knew nothing about the business of the company; he supplied the money and left the business entirely to his brother, Mr. L. R. Wood. The liquidator also said that he was appointed as liquidator on April 10th, and on May 10th he was appointed receiver for the debenture holders. He stated that the greater part of the stock was made up of wireless parts. The creditors decided not to confirm the voluntary liquidation. The following are creditors:—

	£		£
Bergmann Electric Co., Ltd. ...	623	Maltzhm & Sprager	40
Brownie Wireless Co., Ltd. ...	25	Pratt, F.	40
Cleartron Radio, Ltd.	60	Raper, C.	28
Ferranti, Ltd.	20	Rothermel Radio Corporation of Gt. Britain, Ltd.	75
General Electric Co., Ltd. ...	20	Re-Echo Radio Co., Ltd. ...	40
International Wireless Manufacturers	75	Rochester Automobile Co., Ltd.	86
Metro-Vick Supplies, Ltd. ...	40		

SCAMMELL & ABBOTT, LTD., Birmingham, electricians, and dealers in radio goods.—A further meeting of creditors was held recently. At the previous meeting a statement of affairs was submitted which disclosed liabilities of £1,572, all due to unsecured creditors, while the net assets amounted to £276, leaving a deficiency of £1,296. Messrs. Scammell and Abbott were both present at the adjourned meeting, and stated that according to a balance sheet which was prepared up to the end of May, 1925, the company was then solvent. At that time there were certain moneys due to them in respect of undrawn salaries. The business was disposed of a few weeks previously by the receiver for £400. It appeared that for the past year the trading of the company had resulted in heavy losses. It was decided to confirm the voluntary liquidation of the company, with Mr. W. F. Chaundy, Birmingham, as liquidator. A committee of inspection was also nominated, consisting of Messrs. A. Cripwell, Wood, and F. E. Bendall.

FULLER'S UNITED ELECTRIC WORKS, LTD.—Mr. Justice Romer, in the Companies Winding-up Court, on June 1st, again had before him a petition for the compulsory liquidation of this company. Mr. Hunt, Counsel for the judgment creditor (Mr. R. H. Symonds), said the petition was stood over for a scheme of arrangement, but his client had received no communication from the company since, and so far as he could say, no scheme of arrangement was forthcoming. He, therefore, asked his Lordship to make the usual order for compulsory winding-up. His Lordship made this order.

RADIO PHONOPHORE & ELECTRIC, LTD.—Mr. Justice Romer, in the Winding-up Court on Tuesday, adjourned the petition of Mr. C. W. Slingo, of Ealing, for an order for the compulsory liquidation of this company. Counsel for petitioner said he understood that negotiations were proceeding, which it was hoped would lead to the purchase of the company's business, and to the payment of all the creditors.

ACE BATTERY CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Sands, Imperial Buildings, Victoria Street, Nottingham.

MAYWOOD ENGINEERING AND ELECTRICAL MANUFACTURING CO., LTD.—Winding up voluntarily. Liquidator, Major L. Russell-Wood, 27, Charles Street, Holland Park, W.11.

DOUGLAS SOUTHERN ELECTRIC TRAMWAYS, LTD.—A meeting of creditors was held on June 3rd, at the offices of the Liquidator, Mr. L. N. Jackson, 71, King Street, Manchester. Particulars of claims to the Liquidator by July 5th.

BRISTOL & SOUTH WALES ELECTRIC WELDING CO., LTD.—Particulars of claims to the Liquidator, Mr. P. Jones, Premier Buildings, 6 and 7, St. John Square, Cardiff, by June 14th.

GENERAL ELECTRIC TRAMWAYS CO., LTD.—Winding up voluntarily. Liquidators, Messrs. T. Gower and H. W. Davis, 88, Kingsway, W.C. A meeting of creditors was held on May 31st. Particulars of claims to the Liquidators by June 30th.

Private Arrangements.—J. V. BRITTAIN, electrical and wireless engineer, 121a, Liverpool Road, Stoke-upon-Trent.—The creditors interested herein were called together recently, when a statement of affairs was submitted which disclosed liabilities of £6,112 and net assets of £2,931, leaving a deficiency of £3,181. It was reported that debtor started business in November, 1923, without capital. Some time ago he opened a cycle factoring business in Liverpool Road and traded as the Stirling Engineering Co. In reply to questions, it was stated that the turnover in 1924 was approximately £12,000 and in 1925 £20,000. Very little gross profit had been made. It was decided to accept a composition of 7s. 6d. in the £ payable as to 3s. 4d. in three months, 3s. 4d. in six months, and the balance in nine months, secured by the execution of a deed of assignment in favour of Mr. G. G. Poppleton, Birmingham, as trustee, with a committee of inspection. The following are the principal creditors:—

	£		£
Siemens & English Electric Lamp Co., Ltd.	750	Graham, Alfred, & Co.	172
Metro-Vick Supplies, Ltd. ...	200	Pope's Electric Lamp Co., Ltd.	313
Marconiphone Co., Ltd.	180	Edison Swan Electric Co., Ltd.	440
Burndept Wireless, Ltd.	85	General Electric Co., Ltd. ...	200
		Falk, Stadelmann & Co., Ltd. ...	270

The Erste Brunner Machinery Works.—A Vienna correspondent of the German *Vossische Zeitung* draws attention in the issue of that journal for May 18th to the position of the Erste Brunner Maschinenfabriks Gesellschaft, which was rightly regarded as one of the greatest industrial undertakings in former Austria-Hungary, and in Czecho-Slovakia after the collapse of the dual monarchy The company had always paid high dividends and transferred considerable sums to reserve funds. Under the influence of the large banks in Vienna it was able to obtain a big dollar loan in the United States last year, the undertaking tending financially more towards Vienna than to Prague and the interests of the Stock Exchange being greater in Vienna than in Prague, as numerous Austrian shareholders had retained their shareholdings despite the fact that the concern had passed into Czecho-Slovakia. Suddenly a fall in the quotations for the shares of the Brunner undertaking took place and this continued after the markets in other directions had begun to show signs of recovery. The directors announced after a meeting held in February that the dividend for 1925 could be estimated at 25 Czech crowns, with corresponding allocations to the reserve fund, this result comparing with 35 Czech crowns in the previous year. This diminution in the results by no means justified the constant fall in the shares; wild reports got into circulation without, however, the directors finding it necessary to take up a position in regard to them. This incomprehensible situation continued for two months until it was learned that Dr. Franz Pauker, general director of the Brunner Works, had resigned. The directors have now communicated the results of a further meeting, their statements confirming the worst apprehensions. There is no question of any profits for 1925; the secret reserves and probably a large part of the open reserves (56,000,000 Czech crowns) will have to be drawn upon for the extinction of the losses which have been suddenly ascertained. The directors' communication is silent on what has really happened, but the correspondent states that it appears to have been established that false balance sheets have been prepared perhaps for years, in which the stocks, debtors, doubtful claims and even the claims in foreign currency, have been entered at a level far in excess of their real value. The correspondent adds that the losses incurred by the shareholders are immense and that it is incomprehensible how these conditions could have escaped the patronising banks or the investigation which was carried out on behalf of the New York banking firm before the loan of 4,000,000 dollars was granted.

The Pulverised Fuel Plant for Barking.—The contract for the installation of pulverised fuel-firing at the new extension of the County of London Company's power station at Barking will take nearly three years to complete at a cost of more than £750,000. The Lopulco system is to be installed (International Combustion, Ltd.), and we are informed that the contract includes ten B. & W. boilers of 16,500 square feet heating surface, ten Usco air heaters of 18 600 sq. ft. heating surface, ten "Lopulco" furnaces that will absorb 65,000 sq. ft. of Murray fin tubing, ten 15-ton super Raymond pulverising mills, ten exhausters ten cyclones, ten economisers, each with 6,100 sq. ft. heating surface, ten super-heaters, each with a heating surface of 6,500 sq. ft., 20 induced and ten forced draft fans. Each combustion chamber will have a volume of 10,800 cubic feet, based on a combustion of 24,000 B.th.u.'s per cubic foot maximum, and approximately 16,800 B.th.u.'s per cubic foot normal rating. Each combustion chamber will be fitted with 11 burners with Usco suspended arches. In addition, there will be five chimneys complete with two grit catchers, boiler feed pumps, Bailey instruments, boiler house plant buildings, turbine house buildings and switchgear house buildings.

Unemployment.—On May 17th the number of persons registered as unemployed was 1,612,700. This total was 36,801 more than on May 10th and 427,680 more than on the equivalent date of 1925. In addition to the total given above claims for benefit had been lodged by 408,000 persons affected by the coal dispute and the general strike.

Book Notices.—" Touring by Motor Coach " (114 pp. and map). Atherton (Lancs.): The Lancashire United Tramways, Ltd. Price 6d.—This handbook contains full particulars of the company's motor services which cover a very wide area. It is also an illustrated guide book to the places served by the coaches.

The McGraw-Hill Publishing Co., Ltd., 6, Bouverie Street, E.C.4, has issued its May list of books on mechanical engineering and allied subjects. A brief indication of the scope of each work is given.

Handbooks of the U.S.A. Bureau of Standards: No. 6, " Safety Rules for the Installation and Maintenance of Electrical Supply Stations " (10 cents); No. 7, " Safety Rules for the Installation and Maintenance of Electric Utilisation Equipment " (15 cents).

" Southampton Docks." (Pp. xlix + 135, ill.) London: Southern Railway Co.—This profusely-illustrated brochure contains full particulars of the facilities available at the Southampton Docks, with details of handling charges, &c., as well as a great deal of general information of service to shipowners and traders.

" Power-Factor Wastes," by C. R. Underhill. First edition. Pp. xiii + 326; figs. 117. London: McGraw-Hill Publishing Co., Ltd. Price, 17s. 6d.

" *Journal* of the Institution of Electrical Engineers." Vol. LXIV. May, 1926. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.

" *Journal* of the American Institute of Electrical Engineers." Vol. XLV. No. 5. May, 1926. New York: The Institute. Price $1.

Dutch Electrical Exports.—The American Vice-Consul at Rotterdam informs *Commerce Reports* that exports of electrical machinery and equipment from the Netherlands during 1925 increased in volume by 208 metric tons, but fell in value by 1,515,000 florins. The total value was 31,135,000 florins and the weight 12,914 metric tons. There was an increase in practically all classes, the only exceptions being lamps, generators, and small motors. The lamp exports accounted for 21,966,000 florins of the total, as compared with 25,076,000 florins in 1924. The exports of radio apparatus (largely to Great Britain) were doubled in value, and there were appreciable increases in shipments of telegraph and telephone apparatus and cables.

Social Events.—On May 19th about 95 of the employés of the Woking Electric Supply Co. travelled by road to Eastbourne for their annual outing. Upon arrival lunch was served at the Gildridge Hotel, and in the course of the proceedings reference was made to the loyalty of the staff during the general strike. The party returned *via* Horsham and on the way organised a tug-of-war competition in which the Wiring Department proved successful.

To celebrate the opening of the Rotherham Corporation's first power station 25 years ago, the staff held a dinner on May 20th. Alderman A. R. Habershon (chairman of the Electricity Committee) presided, and Mr. E. Cross (chief engineer) and Mr. H. N. Rodgers (superintendent) who were with the original undertaking, were present. Proposing the toast of " The Department," Mr. Rodgers said that during the last two or three years the station had produced electricity at the lowest cost in the country. The total plant capacity had risen from 240 kW 25 years ago to 70,000 kW to-day. Mr. E. Cross, in reply, said that when they started the power station in Rotherham there was a staff of eight, and now there were 308. During the current year they had connected 800 consumers; it had taken from 1901 to 1915 to connect an equal number. Referring to the cost of production, Mr. Cross said that last year they were something like 15 per cent. better than the next best. This year they looked like being 20 per cent. better; the figure for 1926, he thought, would be the wonder of the country, it would probably be from .45d. to .38d. per kWh. Mr. Cross criticised the Electricity Bill, and said that in Rotherham they could generate electricity much cheaper, if left alone, than they would be able to do if the proposals of the Government, as they stood at present, were adopted. Alderman Habershon also replied, and said that it was most important for them to see that their consumers got their electricity at the cheapest possible cost instead of aiding the rates. An excellent musical programme was provided.

The Brush Electrical Engineering Co.'s football club wound up a successful season recently with a dinner at the Boot Hotel, Loughborough. The members of the team were congratulated on winning the championship cup and medals and on being the runners-up in the County Medal competition. Mr. W. J. Hume, who presided, was presented with a replica of the cup in appreciation of his services.

The Laundry Exhibition.—The International Laundry and Allied Trades' Exhibition was held at the Agricultural Hall, N., last week. A great deal of laundry machinery was on view and much of it was electrically-driven; it was noticed, however, that the belt drive was favoured rather than the use of direct-coupled motors. Among the firms showing machinery employing the latter mode of driving were Messrs. Thos. Broadbent & Sons, Ltd., who had upon their stand several examples of hydro-extractors with the centrifuge mounted upon the motor shaft—either above or below the motor. The largest machine shown had a 48-in. diameter container. Messrs. Watson, Laidlaw & Co., Ltd., also showed motor-driven extractors incorporating a safety cover which could only be raised when the motor was at rest. Messrs. Thos. Bradford & Co. exhibited a large drying and finishing machine chain driven by a 7.5-h.p. motor, hot air being supplied by a " Thermofan." The control gear was of " Brookhirst " manufacture. The principal exhibit of Messrs. W. H. Allen, Sons & Co., Ltd., was a steam engine coupled to a 100-kW, 220-V, d.c. generator. The company also showed a 15-b.h.p. crude-oil engine; motor-driven centrifugal pumps; a 35-b.h.p. vertical-spindle motor; and a motor-driven turbine borehole pump. The Hurley Machine Co. displayed its washing, wringing and ironing machines. Two of the last were electrically heated—by no means a common practice here. The smaller ironer has a total loading (*i.e.*, motor and heater) of 1,100 W; there are controls at each end—for either hand, and swinging racks for the ironed articles. The length of the roller is 44 in. and it is eminently suitable for domestic use. The larger machine, designed for small laundries, such as those at institutions, has a 50-in. roller and is equipped with the same easy control devices as the smaller ironer. The Singer Sewing Machine Co. showed a number of electrically-driven and illuminated sewing machines. Messrs. Matthews & Yates, Ltd., exhibited a number of " Cyclone " motor-driven fans and an air washer. Boiler furnaces were displayed by the Turbine Furnace Co., Ltd., and Messrs. Crosthwaite (Leeds), while boilers, boiler fronts, and steam engines were shown by Messrs. Davey Paxman & Co., Ltd.

For Sale.—Mr. A. G. Ralston, of Philipstoun, West Lothian, owing to the change-over to the public supply, has for disposal two 32-kW Westinghouse transformers, two 25-kW rotary converters, and several lengths of armoured cable. Grimsby Corporation Electricity Department invites offers for one 210-kW Belliss & Morcom-Westinghouse steam generating set. Aberdeen Corporation Electricity Department invites offers for one 720-kW d.c. generating set, surface condenser, pumps, &c. Aberystwyth Corporation electricity works has for disposal several generating sets, Paxman boiler, two Worthington pumps, heater, water cooler, pipes, &c. Mr. H. J. Shaw will sell by auction on June 9th, at 13, High Holborn, W.C., wireless and electrical goods and material. (See our advertisement pages to-day.)

A Greek Contract.—*The Times* reports that in face of competition from American, German, French, Swedish, and Italian concerns, the new Antwerp Telephone and Electrical Works has secured sole rights for the reorganisation and exploitation of the Greek telephone and wireless services. The contract is worth about two and a half millions sterling.

Lighting and Power Notes.

Argentina.—HYDRO-ELECTRIC DEVELOPMENT.—Work has recently been completed by the Sociedad Empresa de Luz y Fuerza, of Mendoza, on the construction of a hydro-electric station at Cachenta. The new plant will enable the company to dispense with its small steam-operated generating sets which have been very costly to run owing to the high cost of fuel. The company is now supplying electricity to 11,553 consumers, representing a load of 21,418 kW.

Australia.—VICTORIA.—The Electric Supply Co., Ltd., has prepared a scheme in connection with the acquisition of its undertakings in Bendigo and Ballarat by the local authorities. It proposes that the concession shall be extended for a minimum of 30 years. The local authorities would then be paid a percentage of the profits, according to a sliding scale, and a sinking fund would be formed to permit of the authorities taking over the undertakings free of charge at the termination of the concession.

Arrangements are being made by the Victorian Electricity Commission for dealing with the requirements of further energy by the metropolitan and outer metropolitan districts. The output of energy from the Yallourn and Newport " B " generating plants combined has now reached a total of 627,000 kWh daily, and over 15,000,000 kWh was received at the Yarraville terminal station in March. This quantity exceeded that for the corresponding period of 1925 by more than 50 per cent., and it is anticipated that the following year will exceed the current year for the same period by at least 50 per cent. Works are being carried out to accomplish a change by which energy will be transmitted from the Commission's system to the major portion of the area served by the Melbourne Electric Supply Co. Additional electrical circuits are being arranged between the Yarraville terminal station and the South Melbourne sub-station of the Commission, crossing the River Yarra by two steel towers, each 250 ft. high. A number of additional h.p. sub-stations with connecting mains will complete these works.—*Reuter's Trade Service* (Melbourne).

Beckenham.—ELECTRICITY CHARGES.—The Urban District Council has decided to wire the houses on the Shortlands Estate, and electricity is to be supplied at the fixed weekly rate of 1s. 3d. for two-bedroom houses and 1s. 6d. for three-bedroom houses, all electricity consumed being charged at 2d. per kWh, or if a cooker is installed at 1½d. per kWh.

Bridport.—ELECTRICITY SCHEME.—The Town Council has decided to make application for a loan of £25,000 to carry out an electricity scheme for the town. The power station is to be erected at West Allington and the charges are to be 1½d. per kWh for power and 8d. per kWh for domestic purposes.

Burnley.—MAINS EXTENSIONS.—The Electricity Committee has recommended to the Corporation that mains extensions be proceeded with in the Lowerhouse and Cheapside districts at an estimated cost of £5,000.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — There is a possible development of 600,000 h.p. on the Gatineau River properties controlled by the International Paper Company, according to Mr. A. H. White, of New York, chief engineer of the company, speaking before the Ottawa branch of the Engineering Institute of Canada. The total cost of the storage dam above Maniwaki, the electrical development, and the paper mill, will be in the neighbourhood of $50,000,000. Mr. White confirmed the purchase of Paugan Falls from the Hull Electric Company, and stated that plans and surveys had been made for its development, but that work had not commenced. The power development at Paugan Falls, Chelsea, and Farmer's Rapids, will deliver 405,000 h.p. Of this amount 220,000 h.p. had been contracted for by the Ontario Hydro-Electric Power Commission and the paper mill would require 36,000 h.p.

Chislehurst.—CHANGE-OVER.—The Urban District Council has given its consent to an application from the Foots Cray Electricity Supply Co., Ltd., to change the pressure of supply in its area from 100 to 200 V.

Continental.—BELGIUM.—The report of the Société Intercommunale Belge d'Electricité shows that the capacity of the plant at its eight power stations increased from 124,250 kW to 150,250 kW. The sales of electricity during 1925 were 36 per cent. in excess of those of the preceding year. In order to provide against any interruption in the supply, the central stations at Sweveghem, Alost, and Malines are being linked together by a 50,000-V transmission line. In order to meet the increasing demand the Société Bruxelloise d'Electricité, of Brussels, is increasing its capital from 15 to 22 million francs with the object of adding a new 30,000-kW turbo-generator at its power station, the output of which last year increased by 30 per cent.

The Société d'Electricité de la Campine, which was formed some time ago, has so far confined its attention to the distribution in a number of communes in the province of Limburg of electric power obtained from collieries in the Limburg and Antwerp provinces. It has now decided to establish its own power station of from 15,000 to 20,000-kW capacity at a convenient point in the new Campine coalfield.

SWEDEN.—Considerable changes have recently been effected at the hydro-electric station at Trollhattan, Sweden, bringing the capacity of the plant up to 120,000 kW. Two of the 10,000-kW sets have been converted from 25 to 50 cycles, while two of the turbines have been provided with double generators, one for either frequency. A 132-kV transmission line has also been established between the Trollhattan plant and the State steam-operated power station at Västeras.

GREECE.—It is reported that a syndicate has been formed in Athens to establish a large hydro-electric station to utilise the power of the Vladova Falls about 75 miles west of Salonica.

ITALY.—The Società Generale Elettrica de l'Adamello is doubling the capacity of its power plant at Adamello, which when completed will be able to supply 300 million kWh per annum.

Ealing.—LOAN SANCTIONED.—The Town Council has received sanction to the borrowing of £52,547 for mains and services, and £67,453 for works on consumers' premises, in connection with the change-over of its system of electricity supply.

Fleetwood.—NEW PLANT.—The Urban District Council is to install a 2,000-kW set, a new boiler and auxiliary plant at its electricity works at a cost of £21,000, and application is being made for sanction to a loan for this purpose.

Glasgow.—PROGRESS DURING APRIL.—During April 110 houses were wired under the Corporation's assisted wiring scheme, bringing the total to date to 2,232. The number of applications for the hire of appliances was 110, bringing the total to date to 10,291.

Guildford.—ELECTRICITY IN BULK.—The Electricity Committee has under consideration the question of providing bulk supplies from the new generating station to neighbouring authorities. The Cranleigh Gas & Electricity Co. is applying for an Electricity Order for the Cranleigh area based upon a bulk supply from the Corporation.

Hornsey.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £26,000 for mains and services

Leeds.—ELECTRICITY IN BULK.—The Electricity Committee has received consent to an extension of the agreement for the supply of electricity in bulk to the Morley Corporation.

London.—ISLINGTON.—The Electricity Committee has decided to install four additional h.p. feeders at an estimated cost of £25,000.

Mansfield.—NEW SUB-STATION.—The Electricity Committee has recommended to the Town Council the erection of a 100-kW sub-station in connection with the supply of electricity to Mansfield Woodhouse, and that application be made for sanction to a loan of £2,500 for this purpose.

Melton Mowbray.—STREET LIGHTING.—The Urban District Council has accepted the tender of the Melton Mowbray Electric Light Co., Ltd., for public lighting for a term of five years at £225 per annum. and 4½d. per kWh for electricity consumed, the company to maintain and renew all standards, &c.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

GILLINGHAM.—Heating, cooking and domestic purposes: 1½d. per kWh for the first 100 kWh per quarter and 1d. per kWh beyond.

GUILDFORD.—Lighting: First 500 kWh per quarter from 7½d. to 6¾d. per kWh; all energy in excess of this amount from 4½d. to 3¾d. per kWh. Power and heating: First 500 kWh per quarter, from 2¾d. to 2½d. per kWh; beyond, from 2d. to 1¾d. per kWh. Kinemas and theatres: First 100 kWh per week, from 4½d. to 3¾d. per kWh, above this amount, from 2½d. to 2d. per kWh. Industrial supplies: Combined rate for lighting and power, from 2d. to 1¾d. per kWh.

Preston.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 for the purchase of domestic apparatus to be let out on hire.

Queensbury.—ELECTRICITY SUPPLY.—The Urban District Council has decided to link up with the Yorkshire Electric Power Company, and an electricity supply is promised for next winter.

Shotley Bridge.—ELECTRICITY SUPPLY.—The Cleveland and Durham County Electrical Power Distribution Co. is considering a proposal to provide a supply of electricity to Shotley Bridge and district.

Siam.—BANGKOK.—The Siam Electricity Co., of Bangkok, in order to meet the increasing demand for electricity supply, has recently ordered a new 5,000-kW turbo-generator set. The old boilers are also to be replaced by new ones, a modern switchboard installed, and the distribution system re-arranged to meet present-day requirements.

South Africa.—CAPETOWN.—According to the *South African Engineer*, the electrical engineer (Mr. G. Swingler) estimates that the total sum of £200,000 will be required for extensions and reconstruction of the electrical system during this year.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Colwyn Bay Urban District Council to supply electricity in part of the rural districts of Conway and Glan Conway; the Burton-on-Trent Corporation to supply in the urban district of Swadlincote and parts of the rural districts of Repton, Hartshorne, Seals, and Tutbury; the Electrical Distribution of Yorkshire, Ltd., in the rural district of Wetherby and part of the rural district of Wharfedale; the Orford Electric Light & Power Co., Ltd., in the urban districts of Leiston-cum-Sizewell, and parts of the rural districts of Blything, Plomesgate, and Woodbridge; the Long Eaton Urban District Council in part of the urban district and part of the parish of Toton; Mr. J. A. Purves in the urban district of Bungay; and the Worthing Corporation in parts of the rural district of East Preston, Thakeham, and Steyning West.

Applications for Special Orders have been made by the following authorities:—The Southwold Electricity Supply Co., Ltd., for the supply of electricity in the borough of Southwold and part of the rural district of Blything; the Whitstable Electric Co., Ltd., to extend its area of supply so as to include part of the rural district of Blean; the Leatherhead & District Electricity Co., Ltd., to supply in parts of the rural districts of Epsom, Reigate, and Dorking; and the Torquay Corporation in parts of the rural districts of Newton Abbot and Totnes.

Stoke-on-Trent.—NEW PLANT.—The borough electrical engineer has submitted a report to the Town Council on plant extensions at the electricity works, and the Council has resolved to apply for sanction to install an additional 10,000-kW set and two new boilers, and to a loan of £160,000 to carry out the extensions.

Strathpeffer and Dingwall.—TEMPORARY REDUCTIONS.—The Strathpeffer and Dingwall Electric Co., Ltd., has decided during the duration of the coal dispute to reduce the charge for electricity for heating and cooking to 2d. per kWh. The rate also applies to dwelling houses charged on the valuation system.

United States.—BAY OF FUNDY SCHEME.—Preliminary permits for hydro-electric development on Passamaquoddy Bay, Me., involving the utilisation of the Bay of Fundy tide, have been issued by the Federal Power Commission to Dexter P. Cooper, Inc., New York City. This is the first action taken by the Commission on this proposed development, which is expected by its promoters to yield 500,000 h.p The scheme involves the construction of a number of dams between the islands at the mouth of the bay, so as to make use of the rise and fall of the tide, which amounts to more than 25 ft.—*Reuter's Trade Service* (Washington).

Wirral.—ELECTRICITY SUPPLY.—The Rural District Council has been recommended by the Electricity Committee to accept the offer of the Birkenhead Corporation for an electricity supply. Birkenhead Corporation, it is suggested, should administer the Order granted to the Rural District Council and electricity will be supplied in the Council's area on the same terms as those applying to the out-townships which the Corporation already supplies—*i.e.*, at rates 25 per cent. above those charged in the borough. Birkenhead hopes to be in a position

to supply Moreton with electricity within three months. The completed scheme will cost about £60,000.

The Birkenhead Corporation has received the sanction of the Electricity Commissioners for a "fringe" order to supply electricity to the Plymyard housing estate between Bromborough and Eastham in the Rural Council's area.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—According to the *Industrial Australian and Mining Standard*, the work of preparing the whole of the lines in the Sydney area for electrical operation is rapidly nearing completion (electric trains are already in operation on certain lines), but there still remain to be erected a number of sub-stations and carriage sheds. Sub-stations are being provided at St. Leonards and Gordon, on the North Shore line, and at Lewisham and Homebush, on the main line. The sub-stations at Sydenham, Hurstville, and Sutherland have been completed, and are now in use supplying energy to the trains running on the Illawarra line. On the Bankstown line a sub-station is being erected at Belmore. The large carriage sheds at Punchbowl and Mortdale have been completed, and are now in use.

Blackpool.—NEW CARS.—The Corporation proposes to spend over £15,000 on new tramcars and equipment this year.

Continental.—PORTUGAL.—The work of electrifying the steam railway between Lisbon and Cassas is rapidly approaching completion, and it is expected that the new system will be ready for operation during the coming summer.

SPAIN.—A new electric railway 23 miles in length, known as the Urola, has lately been completed between Zumarraga and Zumaya. The necessary energy is supplied at 30,000 V, three-phase, a.c. from the power station of the Sociedad Hidro-Electrica Iberica, and is converted to 1,500 V d.c. at a transformer station at Azpeitia by means of two sets of transformers and mercury rectifiers. The rolling stock consists of seven motor coaches for passenger coaches and seven motor goods wagons. Each vehicle is provided with four 75-h.p. motors, and although 1,500 V d.c. is used for traction purposes, a converter is installed on each vehicle to enable the controller, the brakes, and the lighting to be operated at 110 V.

Darlington.—RAILLESS CARS.—The Electricity and Transport Committee has appointed a sub-committee to consider and report upon the question of introducing new railless-car services.

Oldham.—TRACK RENEWALS.—The Tramways Committee has under consideration the relaying of the tramway track from Sheepfoot Lane to Royton Town Hall, at an estimated cost of £10,000.

Royton.—TRACK RENEWALS.—According to the *Electric Railway and Tramway Journal*, the Oldham Tramways Committee and representatives of the Urban District Council failed to come to an agreement with regard to the relaying of the tramway track in Oldham Road, Royton, and the running of 'buses in that district. In consequence of the deadlock an appeal has been made to the Ministry of Transport to send an inspector to act as arbitrator. The Oldham Tramways Committee is anxious to relay the length of track from Sheepfoot Lane to Royton Town Hall at a cost of at least £10,000. This increased capital expenditure would, according to the agreement entered into, mean a reduction in the rent that Oldham pays to Royton of £250 per route mile. The Council desires that the present track should be used for a year or two longer.

Sheffield.—TRAMWAY EXTENSION.—It is reported that the City Council has sanctioned the extension of the tramway to the Woodseats terminus at an estimated cost of £50,000.

South Africa.—RAILWAY ELECTRIFICATION.—The electrification of the Cape Town suburban services, just begun, marks the last stage in the 1922 development programme of the South African Railways, involving the construction of 850 miles of new track. This follows upon the electrification of the Natal main line between Glencoe and Maritzburg, which, with a track mileage of 300 miles—as far as from London to Carlisle—is now claimed to be the longest electrified main line in the world.—*Financial Times.*

Southern Railway Electrification.—*The Times* reports that the final stage of the Southern Railway's suburban electrification scheme, the total cost of which is £8,000,000, will be reached on June 6th, when electric services will be opened between Charing Cross, London Bridge, and Dartford. The new electric trains will run by way of Greenwich, Blackheath, and Woolwich, Bexley Heath, and Sidcup. This section represents a mileage of 72 track miles, and the cost of its conversion to electric traction has been about £1,100,000. With its completion, the Southern Railway will have a total electric mileage of 647 track miles, which is the largest suburban electric service in the world.

Staffordshire.—ABANDONMENT OF TRAMWAYS.—The Minister of Transport has made an Order authorising the abandonment of part of the tramway and light railways of the Potteries Electric Traction Co., Ltd., as from September 30th next.

West Ham.—TRACK RENEWALS.—The Borough Council has received from the Ministry of Transport sanction to a loan of £33,855 for the reconstruction of the tramway track in Green Street from Romford Road to Barking Road.

Telegraph and Telephone Notes.

Australia.—BALLAN "BEAM" STATION.—About half-way between Ingliston and Ballan, a few miles south of the Ballarat railway line, are the six steel towers of the Australian "beam" wireless-telegraph transmitting station. The main building at the station itself has been almost completed, and the tests will probably be carried out before August. A very short wave length, probably less than 40 metres, will be used at the Ballan station, the cost of which is likely to be less than one-third of the cost of a long-wave station; six masts, each 250 ft. in height, are required, and it is expected that the power to be used by the transmitters will be about 25 kilowatts. The site at Ballan is about 1,800 ft. above sea level, and is free from "shielding" hills. The masts stand on a plateau slightly elevated above the surrounding country. The station will consist of two separate transmitters, one for communication direct with England and one for working with Canada. Two aerial systems will be needed, each supported by three masts, and the angle of the beam will be about 45 degrees. In the morning the aerial pointing to the north-west will be in use, when the beam path to England will then be for the greater part of its length in darkness; in the evening, however, the beam will be sent in a south-easterly direction, going round the other half of the earth, which will then be in darkness. The Canadian aerial will transmit in a north-easterly direction only. All the electricity for working the transmitters as well as for domestic purposes in the cottages of the station staff will be generated at the station. Each engine and generator is set in a block of concrete which rests on a bed of compressed cork to prevent vibration being communicated to the transmitting apparatus; the concrete blocks on which the transmitters will be built will also be set on beds of cork. Messages will be transmitted from the offices of Amalgamated Wireless (Australasia), Ltd., by whom the station is owned, in Melbourne at a speed of 100 words a minute by means of a telegraph line to Ballan.—*Reuter* (Melbourne).

France.—TELEPHONE SERVICE.—The development of the Government-owned telephone system has improved since the war, but long-distance lines are wholly inadequate, while rural lines are almost unknown. The first of the five long-distance cables planned, the one to Strasbourg, is to be completed shortly. In June, 1923, the French Parliament voted to replace with automatic equipment the manual systems in a number of the larger cities. An appropriation was made for this purpose, but subsequent depreciation of the franc rendered it inadequate, though Nice, with 4,900 lines; Orleans, with 3,200 lines; and Dieppe and Vichy, with 800 lines, each, have been changed over and 5,000 lines at Le Havre have been finished, but not yet placed in operation. Contracts for the installation of automatic systems at Bordeaux and Lyon have been let and the Montpellier exchange of 3,000 lines, is under construction, as are others at Nantes, Reims, Colmar, and Fontainebleau. The Government has appropriated 210,000,000 fr. for an automatic system in Paris. The first contract will be for 40,000 lines, and ultimately there are to be 130,000, says *Commerce Reports*. Eleven new exchange buildings, to supplement the present 14, are now under construction.

JOINT COMMITTEE.—With the object of increasing the value of the telephone service to the public, the French Minister of Posts and Telegraphs in Paris recently appointed the Comitè Pratique d'Amelioration du Service Telephonique, composed of telephone users and officials of the telephone department.

Morocco.—SMALL RADIO STATION.—A small wireless telegraph receiving and transmitting installation has recently been carried out at the offices of the Spanish Consulate in Tangier to afford communication with the wireless service in Africa and with Madrid. The power of the plant is only ½ kW, but satisfaction is expressed at the fact that it is the first all-Spanish plant to be installed.

New Atlantic Cable.—"PERMALLOY" TYPE.—Unfavourable weather delayed the landing of the English shore-end of the Western Union Telegraph Co.'s new cable from Bay Roberts, Newfoundland, to Sennen Cove, Cornwall, last week. The shore-end is about six miles in length and was landed from the steamer *Clyde Firth* on May 27th. The ocean span will be carried across to Newfoundland by the c.s. *Colonia* in July; returning to England the ship will load the final section of cable, which will be laid from Newfoundland to New York. The new "permalloy"-loaded cable, capable of transmitting 2,500 letters per minute, is the first of its kind to be landed in this country.

The Telephone Service.—DEPOSIT MONEY.—Asked in the House of Commons if he could state the amount of unclaimed deposit money held by the telephone service, Viscount Wolmer, Assistant Postmaster-General, in a written reply, states that figures are not readily available of the amount of deposit money still in the hands of the Post Office owing to inability to trace the addresses of the ex-subscribers to whom it belongs. During last year about £1,640 accumulated in this manner.

DEVELOPMENT.—In March last, just fifty years after the invention of the telephone, the total number of telephones in Great Britain and Northern Ireland was 1,421,150, of which 1,390,153 belonged to the Post Office system, 11,000 to railway and other private installations communicating with the national system, and about 20,000 to the systems maintained by Hull and the Channel Islands.

Radio Notes.

Australia.—NEW HOBART STATION.—Hobart is to have a new broadcasting station capable of transmitting throughout the Commonwealth. The existing station (7 ZL) has been taken over by the Tasmanian Broadcasters Pty., Ltd. (a company registered in Hobart last February), and will be moved to larger quarters ready for operation by July.

Holland.—STATION RE-OPENING.—It is understood that the transmitting station at The Hague is to be brought into operation again this month. At such times as Hilversum is not transmitting, PCGG will broadcast on a wave-length of 1,500 metres, and attempts are to be made to reach the Dutch East Indies on a 130-m. wave.

Japan.—NEW OSAKA STATION.—Work has commenced on a site in Otemae, where the Osaka Radio Broadcasting Bureau is to build its main station. According to *Eastern Engineering*, the site covers 754 tsubo and the term is for 20 years. At an estimated expenditure of y.690,000, the Bureau plans to build a three-storied ferro-concrete structure with three radio rooms, the first intended for foreign music, the second for Japanese music, and the third for lectures, with a battery room on the first floor of the main structure, so as to make broadcasting possible even in case of the failure of the supply of electricity. The height of the antennæ will be 250 ft. It is planned to complete the construction before the end of the year.

Netherlands East Indies.—PRELIMINARY REGULATIONS.—No new permits for radio-telegraph stations will be granted to individuals or private companies in the Netherlands East Indies, while existing or future permits to broadcast by radio-telephony are subject to cancellation, according to a statement published in the *Algemeen Indisch Dagblad*, January 22nd, 1926. There is no provision for any monopoly, either broadcasting or merchandising, but the Government may, obviously, create a monopoly of the former. The stations licensed must be capable of reaching all parts of the archipelago; private broadcasters may not interfere with Government stations, and available Government stations may be used for broadcasting upon terms to be arranged, says *Commerce Reports*.

South Africa.—LICENCES BY MONTHLY INSTALMENTS.—The Durban Town Council has introduced a scheme, on the combined recommendation of the borough electrical engineer and the town treasurer, for the payment of broadcast licence fees in monthly instalments along with the electric light account, at the rate (for the present fee of £2 5s.) of three shillings per month for ten months, the first payment of fifteen shillings being made to the Post Office as under the existing instalment scheme. The next step to be aimed at would appear to be an extension of the system to country listeners not connected to the municipal electricity mains, whose initial outlay for their receiving sets is already so much greater than that of listeners within crystal set range. The zone system of graduated licence fees (already in force in Australia) may be introduced, says the *South African Engineer*, in connection with the enlarged powers conferred on the Post Office authorities under the new regulations.

Sweden.—NEW STATION.—The Swedish Telegraph Board has concluded a contract with Marconi's Wireless Telegraph Co., Ltd., regarding the delivery of transmitting apparatus for Sweden's first big broadcasting station. The equipment, according to the *Financial Times*, will be similar to that at the English station at Daventry.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Asia Minor.—BAGDAD.—June 28th. Direction Générale des Chemins de fer d'Anatolie. One electrically-driven semi-portal crane. (A.X.3191.)*

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 2528).*

June 16th. Victorian Government Railways. One heavy-current motor generator set. (B.X. 2527.)*

June 16th. City Council. Turbo-alternator, exciter and condensing plant.*

August 11th. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast. — June 12th. Electricity Committee. D.c. switchgear for sub-stations and transformer kiosks. (May 28th.)

Belgium. — June 6th. The municipal authorities of Hollogne-aux-Pierres, province of Liége. Supply and laying of armoured cables to connect the various transformer cabins in the town.

Birmingham.—June 11th. Electric Supply Department. Stores, *viz.*: engineers' tools, &c., required during year commencing July 1st, 1926. Particulars from Secretary, Electric Supply Department, Dale End.

June 11th, 1926. Tramways Committee. Stores required during year commencing July 1st, 1926. Particulars from General Manager, Council House, Congreve Street.

June 21st. Board of Guardians. Installation of electric lighting at the various homes on the Monyhull Colony estate, King's Heath. Specifications from Mr. N. W. Greenway, consulting engineer, Lloyd's Bank Chambers, New Street, Birmingham.

Brazil.—PORTO ALEGRO.—July 8th. Municipal Council. Electrical material for street lighting. (B.X. 2571.)*

Bristol.—June 14th. Electricity Department. Additions to the premises at Feeder Road generating station. (May 28th.)

Burnley.—June 26th. Joint Hospital Board. Electric lighting system at the Sanatorium, Marsden Road. (See this issue.)

Dundee.—June 18th. Electricity Department. L.p. cable. (See this issue.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537.)*

June 19th. Minister of Education. Dynamo and motors.*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

—*Reuter's Trade Service* (Cairo).

Erith.—June 7th. Electricity Department. L.p. cables. (May 28th.)

Epsom.—June 14th. Electricity Department. Removal of boilers and setting them up as fuel tanks, overhead travelling crane, two 300-kW Diesel engine-driven generators and accessories, oil-purifying plant and cooling tower. (May 28th.)

India.—June 15th. India Store Department. 70,000 (approx.) copper bonds for track rails. (May 14th and 21st.)

June 11th. Wireless transmitting sets. Particulars from Department, 11, Belvedere Road, S.E.

Kettering.—June 9th. Electricity Department. Water-softening plant. (May 14th and 21st.)

London.—METROPOLITAN ASYLUMS BOARD.—June 16th. Installation of electric cable for arc light treatment apparatus at St. Luke's Hospital, Lowestoft. (May 28th.)

June 16th. Installation of electric lighting at the Hut Building, Pinewood, Wokingham. (See this issue.)

H.M. OFFICE OF WORKS.—June 14th. Incandescent electric lamps. (See this issue.)

Lurgan.—June 21st. Urban District Council. Oil engines and generators, motor-driven pumps, main switchboard, and underground and overhead mains. (See this issue.)

Manchester.—June 8th. Tramways Committee. One 2-ton steam travelling crane. Specification from Mr. H. Mattinson, General Manager and Chief Engineer, 55, Piccadilly.

July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plants and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (See this issue.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

Normanton (Yorkshire).—Installation of electric lighting at Normanton Wesleyan Church. A. Harris, 23a, High Street, Normanton, Yorkshire.

Otley.—Electric lighting installation at public slaughter houses, Station Road. Quantities, &c., from surveyor to U.D.C., Council Offices.

Rhyl.—June 16th. Electricity Department. 1,000 yd. l.p. armoured cable, 1,915 yd. 11,000-V feeder cable, and switchgear equipment. (May 28th.)

Roumania.—BUCHAREST.—June 8th. Bucharest Tramway Co. 10,000 kg. electrodes, 1,000 kg. electrolytic copper, 3,000 electrolytic copper contact pieces, 1,200 kg. copper plates, 200 kg. brass sheets, 2,500 kg. black insulating varnish.*

South Africa.—June 21st. South African Railways and Harbours. Track bonds for the Cape Town Suburban Railway electrification scheme. (May 28th.)

July 8th. Telegraph material, poles, cross arms, &c. (A.X. 3,173.)*

Stoke-on-Trent. — June 9th. Electricity Department. Two 60,000-lb. per hour water-tube boilers. (May 14th and 21st.)

Uruguay. — MONTEVIDEO. — July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Ardsley (East and West).—District Council. Accepted:—
Electrical installation in 40 "D" type and eight scullery houses (£161).—Radio Electric Co.

Australia.—SYDNEY.—With further reference to the note on page 801, ELECTRICAL REVIEW, May 28th, *Tenders* states that a special meeting of the City Council was held recently to receive and consider the report of the committee appointed in connection with the acceptance of tenders for armour-clad switchgear, 33,000-V transformers, and 33,000-V cable. In the case of offers for armour-clad switchgear for 33,000-V step-down sub-stations, it was agreed to cable the general manager, Mr. H. R. Forbes Mackay, asking him to inspect the 33,000-V installation carried out by Messrs. Ferguson, Pailin, Ltd., at the Manchester Corporation power station, and reply as to the suitability of this equipment for Australia. The original motion was for the acceptance of the tender of Metropolitan-Vickers Electrical Co., Ltd. (second lowest) at £106,038. Messrs. Ferguson, Pailin's offer was £99,760. The latest information to hand is that, at a further meeting of the Council, decision was deferred pending the receipt of cabled advice from Mr. Mackay.

For the supply of 33,000-V transformers, the following offers were accepted :—
Section A, three 10,600-kVA, 33,000-5,350-V forced oil cooled (£12,014); section B, ditto, air cooled (£13,840).—Noyes Bros. (Sydney), Ltd.
Section C (£7,420); ditto E (£10,820); ditto F (£7,000); ditto G (£7,000); ditto H (£7,000); section D (£7,000).—Electrical Plant Manufacturers, Ltd.

For 33,000-V cable, tenders were accepted as follows :—
Item 1, 137,000 yd. .25 sq. in. 3-core, paper insulated, lead covered and armoured (£244,347).—Noyes Bros. (Sydney), Ltd.
Item 2, 17,500 yd. 15 sq. in. 3-core p.i. l.c. and double wire armoured (£27,050); item 3, 47,500 yd. ditto, single wire armoured (£59,137).—British Insulated Cables, Ltd.
Item 4, 75,000 yd. each 7/.036, 3-core and 3 pairs 19 s.w.g. telephone wires, paper insulated, lead covered, armoured pilot and telephone cable (£15,034).—Siemens (Aust.) Pty., Ltd.; (£14,475), Johnson and Phillips, Ltd.
Item 5, 47,000 yd. ditto unarmoured (£6,306).—Johnson & Phillips, Ltd.

Electric Lighting Committee. 18 boilers and accessories. Recommended :—

Babcock & Wilcox, Ltd. (Recommended)	**£622,87 7**
Sterling Boiler Co., Ltd.	£623,730
Vickers Boiler Co., Ltd.	£624,365
Sir W. G. Armstrong, Whitworth & Co., Ltd.	£624,812
International Combustion Co., Ltd.	£633,348
Australian Commonwealth Shipping Board	£1,035,606

Mechanical draught plant (£98,333).—Australian Commonwealth Shipping Board (recommended).

MELBOURNE.—Postmaster-General's Department.
Telephone apparatus.—Siemens Bros. & Co., Ltd. (£1,377); British L. M. Ericsson Mfg. Co., Ltd. (£682).
Equipment in connection with the establishment of a radiophone service between Townsville and Magnetic Island (£548).—Amalgamated Wireless (Aust.). Ltd.
—*Tenders.*

Brighton.—Electricity Committee. Recommended:—
1,500-gallons per hour water-softening equipment (£962).—Kennicott Water Softening Co., Ltd.
Switchboard (£216).—Bruce Peebles & Co., Ltd.
Pipes and castings (£815).—Smith, Patterson & Co., Ltd.

Bridlington.—
Electrical installation at new Spa concert hall (£750).—City Electrical Co.

Chesterfield.—Electricity Committee. Accepted:—
Underground cable (£235).—Standard Telephones & Cables, Ltd.
Overhead line material (£232).—British Insulated Cables, Ltd.

Crieff.—
Electric lighting installation in connection with the new Baptist Church.—Mark Aitken & Sons.

Glasgow.—Watching and Lighting Committee. Accepted :—
Electrical fittings and accessories, &c., for 12 months.—Wm. McGeoch and Co., Ltd.; Simplex Conduits, Ltd.; Thos. Land & Son; Chalmers & Mitchell; Edison Swan Electric Co., Ltd.; Enfield Cable Works, Ltd.; W. Brown & Co. (Engineers), Ltd.; Credenda Conduits Co., Ltd.; Bayliss, March & Newey, Ltd.

Corporation. Recommended :—
Laying the cables in the grounds at Bellefield Sanatorium (£1,593).—Callender's Cable & Construction Co., Ltd.

Government Contracts.—The following Government contracts were placed during April, 1926 :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Electric cable.—W. T. Glover & Co., Ltd.
Electric fires.—Berry's Electric, Ltd.
Aerial insulators.—G. H. Williams & Co.
Motor generators.—Newton Bros. (Derby), Ltd.
Switches.—Whipp & Bourne, Ltd.
Electric tractor.—Electromobile, Ltd.
W/T. transmitters.—Gambrell Bros., Ltd.; H. W. Sullivan, Ltd.; Plessy Co. (1925), Ltd.
Enamelled copper wire.—British Insulated Cables, Ltd.
W/T. boards.—Dorman & Smith, Ltd.; Whipp & Bourne, Ltd.; Veritys, Ltd.
W/T. fittings.—Player & Mitchell.
Lamp ferrules.—Edison Swan Electric Co., Ltd.

WAR OFFICE.
Wireless valves.—British Thomson-Houston Co., Ltd.

AIR MINISTRY.
Electric lighting (Spittlegate).—Malcolm & Allan, Ltd.
W/T. receivers.—H. W. Sullivan, Ltd.
Transmitters and receivers.—Gambrell Bros., Ltd.
Wavemeters.—H. W. Sullivan, Ltd.
Inert batteries.—Edison Swan Electric Co., Ltd.

POST OFFICE.
Manufacture, supply, drawing-in and jointing cable.—Rushden-Finedon Junction: Standard Telephones & Cables, Ltd.
Installing and jointing loading coils and terminating cable.—Ipswich-Marks Tey: Johnson & Phillips, Ltd.
Direction-finding apparatus.—Wick Wireless Station: Marconi's Wireless Telegraph Co., Ltd.
Telephone exchange equipment.—Blackpool, Dundee, Broughty Ferry: General Electric Co., Ltd. Grangewood (East Ham): British L.M. Ericsson Mfg. Co., Ltd. Malden, Primrose Hill: Automatic Telephone Mfg. Co., Ltd. Kingston, Bournemouth: Standard Telephones and Cables, Ltd.
Private branch exchange equipment.—J. Heywood, Ltd. (Manchester); E. Pollard & Co., Ltd. (E.C.); Shoreditch Borough Council; Edmonton Board of Guardians; Morris Commercial Cars, Ltd. (Smethwick); Transport and General Workers' Union (S.W.); J. Henshelwood and Co., Ltd. (Glasgow); *Bristol Times and Mirror, Ltd.*—Relay Automatic Telephone Co., Ltd.
Telephone repeater station (repeater equipment).—Canterbury: General Electric Co., Ltd. Fenny Stratford, Derby: Standard Telephones and Cables, Ltd.
Telegraph apparatus.—Creed & Co., Ltd.; Standard Telephones & Cables, Ltd.
Telephone apparatus.—British L.M. Ericsson Mfg. Co., Ltd.; International Electric Co., Ltd.; C. Lange; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing and protective apparatus.—Evershed & Vignoles, Ltd.; Power Equipment Co., Ltd.; Standard Telephones & Cables, Ltd.
Terminal Blocks.—T. De la Rue & Co., Ltd.
Battery boxes.—British L.M. Ericsson Mfg. Co., Ltd.
Cable (various).—Connolly's (Blackley), Ltd.; Enfield Cable Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Lamp caps.—W. Johnson.
Wood casing.—Duncan Tucker & Sons, Ltd.
Joint box castings.—Ladywood Ironworks, Ltd.; McDowall, Steven and Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Telephone cords.—Peel-Conner Telephone Works; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Ward & Goldstone, Ltd.
Ducts.—James Oakes & Co., Ltd.; Standard Brick & Terra Cotta Co., Ltd.
Battery sections.—Accumulators of Woking, Ltd.
Cadmium copper wire.—T. Bolton & Sons, Ltd.; R. Johnson & Nephew, Ltd.
H.d. copper wire.—British Insulated Cables, Ltd.; T. Bolton & Sons, Ltd.; Elliott's Metal Co., Ltd.; Johnson & Nephew, Ltd.; E. & E. Kaye, Ltd.; Nevill, Druce & Co., Ltd.; Pirelli-General Cable Works, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.; Wilkes, Son & Mapplebeck, Ltd.
V.l.r. wire.—Callender's Cable & Construction Co., Ltd.
Switches.—Edison Swan Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.
Electrical portal cranes.—Sir W. G. Arrol & Co., Ltd.
2-ton electric portal wharf crane.—Sir W. G. Armstrong, Whitworth and Co., Ltd.
Generating plant.—Ruston & Hornsby, Ltd.; National Gas Engine Co., Ltd.
Electric headlight.—Baldwin Locomotive Works, Ltd.
Insulators.—Taylor, Tunnicliffe & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
X-ray plant.—Watson & Sons (Electro Medical), Ltd.
Telephones.—British L.M. Ericsson Mfg. Co., Ltd.
Telephone switchboards.—Siemens Bros. & Co., Ltd.
Train-lighting testing equipment.—Metropolitan-Vickers Electrical Export Co., Ltd.
Bronze and copper wire.—Elliott's Metal Co., Ltd.; Shropshire Iron Co., Ltd.
Copper wire.—F. Smith & Co.

Halifax.—
Electrical Installation at houses in Stamps Lane.—Mr. H. J. Westlake.

Hornsey.—Electricity Committee. Recommended:—
500 fuse boxes (£437).—Motor Gear & Engineering Co.

Irish Free State.—The following contracts were placed by the Controller of Stores (Posts and Telegraphs) from March 23rd-April 22nd :—
Cable and accessories.—W. T. Henley's Telegraph Works Co., Ltd.
Enamelled copper wire.—Hayward Co.
Telephone fuses.—Phœnix Telephone and Electric Works, Ltd.
Telephones.—Siemens Brothers & Co., Ltd.
Telephone accessories.—Standard Telephones and Cables, Ltd.; Sterling Telephone and Electric Co., Ltd.; International Electric Co., Ltd.; Cook Electric Co.; W. J. Kellie.
—*Irish Electrician.*

DUBLIN.—Borough Commissioners. Accepted :—
H.p. switchgear, &c., for Fleet Street and Pigeon House generating stations (£11,305).—Ferguson Pailin, Ltd.
—*Irish Builder and Engineer.*

India.—*Reuter* states that a contract for the complete electrical equipment of the new power house at Lucknow (East Indian Railway) has been placed with the General Electric Co. of India, Ltd.

Kidderminster.—General Hospital Management Committee. Accepted :—
Installation of an automatic telephone system throughout the hospital.—Mr. G. L. Harvey.

Lancashire.—South Lancashire Tramways Co. Accepted :—
Twelve 50-h.p. tramcar motors.—General Electric Co., Ltd.

Leeds.—Tramways Committee. Accepted :—
Tramcar tires.—Steel, Peech & Tozer, Ltd.
Electrodes.—Consolidated Pneumatic Tool Co., Ltd.; Allen Liversidge, Ltd.; Alloy Welding Processes, Ltd.
Tie bars.—Hadfields, Ltd.
Thermit joint material and plant.—Thermit, Ltd.
Rails with fish plates (350 tons approx.).—Cargo Fleet Iron Co., Ltd.
Manganese steel rails (£85).—Edgar Allen & Co., Ltd.
200 tramcar meters.—Ferranti, Ltd.
Malleable iron castings.—Levs Malleable Castings Co., Ltd.

Electricity Committee. Accepted :—
Cables.—(£2,948).—Macintosh Cable Co., Ltd., (£1,481) Enfield Cable Works, Ltd., (£2,948) W. T. Henley's Telegraph Works Co., Ltd.

Baths Committee. Accepted :—
Electrification of lifts at Town Hall (£312) and at Municipal Buildings (£578).—Waygood Otis, Ltd.

Leicester.—Electricity Committee. Recommended:—
15,000-kW turbo-alternator (£28,000).—Oerlikon, Ltd.
The most favourable British offer was £43,327.

London.—LONDON COUNTY COUNCIL.—Accepted :—
Electric incandescent lamps for 12 months.—Siemens & English Electric Lamp Co., Ltd.

BATTERSEA.—Electricity Committee. Recommended :—
Alterations and additions to condensing water system at generating station (£27,746).—Foundation Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Cable.—Pirelli-General Cable Works, Ltd., and Callender's Cable and Construction Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.
33,000-V feeder protective gear.—A. Reyrolle & Co., Ltd.
5-ton electric tipping wagon.—Richard Garrett & Sons, Ltd.
10-ton electric tractor and trailer.—General Vehicle Co., Ltd.
Steelwork for boiler at Barton.—John Booth & Sons.

Gas Committee. Accepted :—
Three water-tube boilers.—Sterling Boiler Co., Ltd.
Two 250-kW steam engines.—Brown, Lindley & Co., Ltd.
Two 250-kW open-type dynamos.—Electric Construction Co., Ltd.

Tramways Committee. Accepted :—
Vestibule tramcar bodies.—English Electric Co., Ltd.
Maximum traction trucks.—Brush Electrical Engineering Co., Ltd.
Tramcar motors and controllers.—British Thomson-Houston Co., Ltd.
Fifty 50-h.p. tramcar motors.—General Electric Co., Ltd.

Mansfield.—Town Council. Accepted:—
Electric wiring of the hospital.—G. Hooke & Co.

Rathmines.—Urban District Council. Accepted:—
Meters for 12 months.—Edison Swan Electric Co., Ltd.

Salford.—Electricity Committee. Recommended:—
8,500 yd. l.p. cable (£2,871), 436 yd. l.p. cable (£272); and 2,612 yd. e.h.p. cable (£838).—N.V. Nederlandsche Kabelfabriek, Delft, Holland.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted :—
Cable.—(£826) Bartle & Co., (£4,521) W. T. Henley's Telegraph Works Co., Ltd., (£7,253) Telegraph Mfg. Co., Ltd.
Overhead material, poles, cross-arms, &c.—(£6,793) Hubert Davies and Co., Ltd. (£607) British General Electric Co., Ltd., (£822) Telegraph Mfg. Co., Ltd., (£248) Griffin Engineering Co., Ltd., (£649) Mr. C. E. Scott, (£1,489) A. Vaux, Ltd., (£647) Davis & Soper, Ltd.
Recommended :—
7,500/8,000-kW turbo-alternator (£21,006).—Metropolitan-Vickers Electrical Co., Ltd.

Stirling.—Town Council. Accepted:—
Installing electric light in connection with the Drip Road housing scheme.—Mr. David Henderson.
Electrical work at the Guildhall House.—W. & T. Marshall.

Tynemouth.—Electricity Committee. Accepted:—
Cable (£1,065).—Standard Telephones & Cables, Ltd.

Forthcoming Events.

Royal Institution of Great Britain.—Monday, June 5th. At 21, Albemarle Street, W. At 5 p.m. General meeting.
Friday, June 11th. At 9 p.m. Lecture on "The Spectrum of the Aurora," by Prof. J. C. McLennan, F.R.S.
Institute of Physics.—Monday, June 7th. At the Royal College of Science, South Kensington, S.W. At 5.30 p.m. Lecture on "The Relationship of Physics to Aeronautical Research," by Mr. H. E. Wimperis.
Roentgen Society.—Tuesday, June 8th. At 32, Welbeck Street, W.1. At 8.15 p.m. Annual general meeting and ordinary general meeting.
Radio Society of Great Britain.—Wednesday, June 9th. At the Institution of Electrical Engineers, Savoy Place, W.C. At 6 p.m. Informal meeting.
Salford Technical and Engineering Association.—Saturday, June 12th. Visit to Ferranti, Ltd., Hollinwood.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

ELTRON immersion heaters.
IMPERIAL vacuum cleaners (American).
LATALOID insulation.
ORANGBURG fibre conduit.
RICHMOND vacuum cleaners.
Electric iron stands fitted with springs to absorb shock.

Notes.

How Electricity Supply was Maintained During the Strike.—CORRECTIONS.—In our article on "How Electricity Supply was Maintained During the Strike" the remark that the "Men at Rotherham remained at work as the result of an arrangement with the E.P.E.A. members not to supply the tramways" (page 783, May 28th issue) was somewhat misleading, for we understand that, as the whole of the operating staff there, both technical and manual, were not connected with unions affiliated with the T.U.C., there was no question of them ceasing work.

The statement that in the North Metropolitan Electric Power Supply Company's area the supply was maintained by volunteers and naval men. This was a regrettable error, as our information, since confirmed by Capt. Donaldson, was that all the volunteers employed by the "North Met." offered their services directly to the company, and that the latter did not draw on the Government, either for naval ratings or for volunteers.

National Association of Supervising Electricians.—The meeting arranged for May 4th, to decide the winning papers in connection with the W. E. Highfield Shield Competition, which was postponed owing to the general strike, has now been arranged for Thursday, June 10th, at the Junior Institution of Engineers, London, at 7.15 p.m. The president, Mr. A. M. Sillar, M.Inst.C.E., will be in the chair.

Electrical Engineers in China.—We have received from Mr. C. S. Taylor, hon. secretary and treasurer of the China Centre, Institution of Electrical Engineers, a photograph (reproduced herewith) taken on the occasion of the second annual conference which was held in Shanghai on April 17th last. The programme of the Conference included visits to the Shanghai Electric Construction Co.'s depôt and workshop, to the Tonquin Road super sub-station of the Shanghai Municipal

The China Centre, I.E.E., Conference Dinner.

Electricity Department, to flour and cotton mills, and to the generating station of the Cie. Française de Tramways et d'Eclairage Electriques.

Electricity Supply from Oil Fuel.—The Brompton and Kensington Electricity Supply Co., Ltd., has circulated to its consumers, numbering about 10,000, notice that as the electrical energy supplied by it is generated exclusively by oil fuel, the restriction in consumption required by the Government Order does not apply to its consumers, who are therefore not called upon to practise the economy demanded by the shortage of coal. The company and its consumers are to be congratulated on their independence of coal, an advantage which is shared by the many oil-engine stations which are in operation.

Appointments Vacant.—Mains assistant (£150), for the Cheadle and Gatley U.D.C. electricity department; works superintendent, for the Borough of Newport (Mon.) Electricity Department. Plumber-jointer for the Watford Corporation Electricity Department. (See our advertisement pages to-day.)

Association of Mining Electrical Engineers.—Owing to the disturbed state of the coal trade, it has been decided to cancel the social functions arranged in connection with the annual meeting of the Association at Harrogate. The Council and general meetings will be held there, at 4 p.m. to-day and 10 a.m. to-morrow, for the transaction of formal business only.

Aylesbury Rural Electricity Development.—On Saturday last Mrs. Ll. B. Atkinson, a member of the Council of the Electrical Association for Women, cut the first sod in connection with the Corporation's rural area electricity scheme, in Chequers Park, Aylesbury. The contractors for the scheme (the Craven and District Electrical Construction Co., Ltd.) presented Mrs. Atkinson with a silver spade for the occasion. During the afternoon Mr. Borlase Matthews gave some interesting information with regard to the value of electricity to the farmer, and said that the courageous step which was being taken by the Aylesbury Electricity Committee was one of great significance in the electrical and farming worlds. Mr. Ll. Atkinson thanked the compauy on behalf of his wife, and referred to the excellent work carried out by Mr. W. A. Turnbull, the borough electrical engineer. The Mayor (Alderman C. F. Atkins, J.P.) joined in wishing the enterprise great success, and other speeches were made by Alderman James Robinson, J.P., chairman of the Electricity Committee, and Councillor Viscount Stopford, O.B.E., vice-chairman. At the end of the ceremony, which was held in a most delightful country field, the guests were

entertained to tea in a barn near by. In addition to local people, the party consisted of Mr. W. M. Selvey, consulting engineer, Miss Phyllis Atkinson, Mrs. M. L. Matthews, and Miss Haslett, of the Electrical Association for Women.

Electric Cooking on Board Ship.—The London and North-Eastern Railway Co. informs us that its night mail steamers between Parkeston Quay and Antwerp are now all fitted with electric kitchens.

The I.M.E.A. and the Electricity (Supply) Bill.—At a special general meeting of the Incorporated Municipal Electrical Association which was held at the Institution of Electrical Engineers on May 28th, the following resolution was passed :—

"The I.M.E.A. having considered the proposals of the Electricity (Supply) Bill, 1926, believe that in its present form it will not attain the object for which it is being promoted, *viz.*, cheaper electricity to the consumers, which is a forerunner to its more widespread use. The proposals of the Bill are too cumbersome, as well as costly and unworkable, and the Association considers that before any legislation is proceeded with representatives appointed by the electricity supply industry should be consulted and given an opportunity of submitting proposals as to the most satisfactory manner of effecting any desired improvement.

"The Association further is of the opinion that the figures in, and conclusions of, the 'Weir' Report are open to serious doubt, and also deprecates the suppression of the 'Merz' Report and the undue haste with which the Government has pressed the scheme."

Institution Notes.

Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur on September 30th, 1926 :—President: W. H. Eccles, D.Sc., F.R.S. Vice-President: Col. T. F. Purves, O.B.E. Hon. Treasurer: Lieut.-Col. F. A. Cortez Leigh, T.D., R.E. Ordinary Members of Council: A. C. Cramb, A. H. Railing, D.Eng., S. Parker Smith, D.Sc., A. J. Stubbs; Associate Member, F. W. Crawter.

PREMIUM AWARDS.—The Council has awarded the following premiums for papers read or accepted for publication during the 1925-26 session :—The Institution premium to Mr. L. C. Grant; Ayrton premium to Mr. S. Mavor; Fahie premium to Messrs. B. S. Cohen, A. J. Aldridge, and W. West, B.A.; John Hopkinson premium to Mr. S. Ferguson; Kelvin premium to Mr. P. Dunsheath, O.B.E., M.A., B.Sc.; Paris premium to Mr. T. Carter; extra premiums to Prof. S. P. Smith, D.Sc., Messrs. J. L. Thompson, M.Sc., and H. Walmsley, and Dr. A. B. Wood; wireless premiums to Messrs. R. A. Watson-Watt and J. F. Herd, Mr. J. Hollingworth, and Dr. R. L. Smith-Rose, Ph.D., M.Sc., and Mr. R. H. Barfield, M.Sc.

Institution of Mining Engineers.—It is announced that the general meeting of the above Institution, which was provisionally arranged to be held on June 15th and following days at Newcastle-upon-Tyne, has been postponed to later dates, possibly in the early autumn, to be announced later.

Institute of Physics.—The lecture by Mr. H. E. Wimperis on "The Relationship of Physics to Aeronautical Research," which was to have been held on May 11th, will be given on Monday, June 7th, at 5.30 p.m. in the Physics Lecture Theatre, Royal College of Science, South Kensington.

Faraday Society.—The general discussion on "Explosive Reactions in Gaseous Media," postponed from May 13th, will be held on Monday, June 14th.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. R. W. DALTON, H.M. Senior Trade Commissioner in Australia, has arrived in this country for the purpose of an official visit. He will be in attendance at the offices of the Department of Overseas Trade for one month from May 31st, during which period he will be pleased to meet representatives of United Kingdom firms interested in the export of British goods to Australia. Applications for interviews should be made at once to the Comptroller-General at the Department, 35, Old Queen Street, London, S.W.1.

An Australian contemporary states that Mr. G. A. JULIUS has been appointed chairman of the Australian Commonwealth Engineering Standards Association for 1926.

According to the *Industrial Australian and Mining Standard*, Mr. H. S. VOGAN, assistant engineer in chief for existing lines in the N.S.W. Railways Department, has retired from the service and his place has been taken by Mr. W. B. HUDSON, chief assistant engineer, who has been, and will continue to be, responsible for the supervision of the electrification of the suburban lines, and the construction of the new works at Chullora.

Mr. W. J. LIBERTY, public lighting superintendent for the City of London, has resigned his office (under the Corporation Pension Scheme) after forty-seven years' service, having reached the retiring age.

The Stoke Newington B.C. has passed a vote of thanks to Mr. HANN, the borough electrical engineer, for his return to duty during the strike. He was in Switzerland on sick leave and promptly returned and assumed charge of the station.

We understand that Mr. E. F. DARKER, who recently represented the Benjamin Electric, Ltd., in London, is now with the Cape Town Corporation Electricity Department.

According to the *Sydney Daily Telegraph*, the Sydney City Council Electricity Committee has recommended the appointment of Mr. W. RILEY, superintendent of the electricity accounts branch, to the position of sales superintendent, at a salary of £800 per annum.

Mr. H. BURROWS has joined the Mersey Cable Works, Ltd., and all communications should be addressed to him there (Linacre Lane, Bootle).

Mr. FREDERICK C. DAIN has just taken up an appointment under the Blackburn Corporation electricity department as showrooms manager. He was previously on the sales staff of the Manchester Corporation electricity department.

The Halifax Electricity Committee recommends that the salary of the borough electrical engineer be increased to £1,200 per annum from June 1st.

Guildford Town Council has increased the salary of Mr. M. J. DOWNING, mains superintendent foreman, from £247 to £275 per annum.

Mr. JOHN MCLELLAN, A.M.I.E.E., who has been for many years connected with Messrs. Simplex Conduits, Ltd., and for the last few years sales superintendent for the company for the North of England, has severed his connection with the company and commenced a re-selling agency business in Manchester. His address is 78, Park Road, Southport.

According to *The Times*, acting on medical advice, Mr. W. F. SADLER, special director and general manager of Vickers, Ltd., has had to resign those positions.

According to a local newspaper report, the Lighting Committee of the Kingston-on-Thames Town Council reports that on May 6th the engagement of Mr. J. BATCHELOR as chief assistant at the electricity works was terminated forthwith.

Obituary.—MR. CARL HERING.—We regret to learn from the *Electrical World* that Mr. Carl Hering passed away suddenly on May 10th at the age of 66 years. A day or two before he had entered the Hahnemann Hospital, Philadelphia, to rest with heart trouble, and he passed away while picking up a telephone receiver, ten minutes after chatting with his physician. He had had a lengthy and distinguished career in electrical science and engineering. In the electrochemical and electrometallurgical fields especially he achieved international distinction, his discovery of the "pinch" effect being his greatest accomplishment, though by no means his only one. In 1892 he served as technical editor of the *Electrical World*. He originated and for many years conducted the "Digest of Current Electrical Literature" of that periodical. Carl Hering graduated from the University of Pennsylvania in 1880 in mechanical engineering. In 1882, while teaching at the university, he began the study of electrical engineering. In 1883 he published his first technical article, the precursor of a long series of writings, including at least eight books and innumerable papers read before technical societies and contributions to the engineering Press. He acted as a juror for many electrical exhibitions in Europe and at home. He began a course in electrical engineering at Darmstadt, Germany, in 1884. In 1885 he became chief electrical engineer for a German manufacturing company which made and installed motors and dynamos, but he soon returned to his native country, where as early as 1886 he began practice as a consulting electrical engineer in Philadelphia; he therefore lived to complete 40 years in this occupation. Our contemporary says that "Dr. Hering was all his life an enthusiastic searcher for a scientific explanation of apparent exceptions to generally accepted physical laws, and as an outcome of this trait he became a stickler for the correct expression of scientific results in standard units and contributed considerably to the construction and classification of electrical nomenclature." His work in electrochemistry dates back to some tests in 1900 for the reduction of arsenic ore. "Some six years later, while designing and operating electric furnaces, he began a series of experiments which resulted in the announcement of the discovery of a new internal electromagnetic force tending to contract a conductor through which current is flowing even to the extent of rupture when it is a fluid. This discovery was the 'pinch' effect, already referred to. He later demonstrated the existence of other effects showing that the electromagnetic forces act on the material of the conductor. In 1909 he applied these forces to impart rapid motion to masses of molten material, and on this principle invented an electric furnace which is now in wide commercial use. As early as 1883 he began the computation of conversion factors of electrical and mechanical energy, and he published a comprehensive book on this subject in 1904. A few years later he made a recalculation of all electrochemical equivalents. In 1908 he made an analysis of the interrelations of the various quantities of units entering into the calculation of light phenomena. In the same year he described an experiment purporting to demonstrate a hitherto unrecognised factor in electromagnetic induction to show that Maxwell's well-known law of induction should be modified in order to acquire the status of a universal law." Dr. Hering was one of three men who in 1901 laid the plans for the organisation of the American Electrochemical Society. In 1900 he was elected president of the American Institute of Electrical Engineers and presided at a session held abroad. In 1906 he was president of the American Electrochemical Society. It was our privilege to be in close

conference with Dr. Hering during some of his visits to this country, and we can testify to his charming personality, his geniality and courtesy, as well as to his cordiality and assiduity in correspondence on technical subjects in which he was so absorbingly interested.

MR. G. MOILLIET.—A message has been received by cablegram from Japan stating that Mr. Georges Moilliet, the manager of the Tokio office of Boving & Co., Ltd., succumbed to typhoid on May 17th. The deceased was of French-Swiss origin, and was educated at the "Polytechnicum" at Zurich, but Yorkshire is the home of the Moilliets in this country. Mr. Moilliet became associated with Mr. Boving in 1898. He specialised in water power plants, and during his period of training he was in the employ of Escher Wyss & Co., of Zurich, and A.B. Karlstads Mekaniska Verkstad, Kristinehamn, Sweden. In 1908 he took up the position of residential engineer of Boving & Co. in Japan, and his advice on hydraulic power plants was widely sought.

MR. H. F. ALBRIGHT.—The *Electrical World* records the death, on May 11th, of Mr. Henry F. Albright, vice-president in charge of manufacturing and a director of the Western Electric Co. At the time of his death Mr. Albright was in charge of all the company's manufacturing and plant engineering activities.

MR. R. S. RILEY.—The same journal also reports that Mr. R. Sanford Riley, president of the Riley Stoker Corporation, and a distinguished combustion engineer, died on May 7th. Mr. Riley was born in Hamilton, Ontario, in 1875. His most notable work was the development of the Taylor stoker, and the invention of the stoker bearing his name. He was connected with the Riley Stoker Co., Ltd., in this country.

MR. J. L. JONES.—Messrs. A. Reyrolle & Co., Ltd., state that they regret to report the death of Mr. J. Lyons Jones, who has of recent years been in charge of their department dealing with wall plugs and other stock articles. He had been with the company for 18 years. He had been ailing for some time and had only recently recovered from pneumonia when he contracted a fatal chill in travelling to the coast by boat during the strike.

MR. A. H. FELTON.—A newspaper report states that Mr. Arthur Harold Felton (47), superintendent of the East Usk power station, Newport (Mon.), died while playing lawn tennis at St. Julian's.

Mr. C. H. FRYER.—We regret to learn that Mr. Charles H. Fryer, manager of the Glasgow branch of Messrs. Houghton-Butcher (Great Britain), Ltd., for over 20 years, passed away on May 20th.

Mr. ROBERT TAYLOR.—We have to record the death, which occurred on May 21st, at the age of 71 years, of Mr. Robert Taylor, founder, and director for 25 years, of the Liverpool Electric Cable Co., Ltd.

Wills.—The late Mr. GEORGE BERRY, manager of the British Electric Transformer Co., Ltd., left £10,813 (net personalty £2,635).

The late SIR HENRY MANCE left £22,325 gross, and £22,183 net personalty.

New Companies Registered.

Smith & Sturt, Ltd. (213,999).—Private company. Registered May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, &c. The directors are:—W. A. Smith, 28, Avenue Road, Leamington, Warwickshire; M. A. S. Sturt, D.S.O., 288, Mansell Road, Small Heath, Birmingham; and J. A. Stevens, 2b, Shoot-up-Hill, N.W.2 (director of J. A. Stevens, Ltd.). The first two named are permanent. Registered office: 192, Corporation Street, Birmingham.

Mirrlees Watson Co., Ltd. (14,155).—Private company. Registered in Edinburgh on May 20th. Capital, £100 in £1 shares. Objects: To carry on the business of mechanical, electrical, hydraulic and marine engineers, ship and boat builders, manufacturers of locomotive engines, &c. The directors are:—A. F. Baird, 124, St. Vincent Street, Glasgow, solicitor; C. Day, Highfield, Mile End, Stockport, engineer; H. N. Bickerton, Thorneycroft Hall, Siddington, Cheshire, engineer; C. Ker, Milngavie, Glasgow, C.A.; A. Lamberton, Easterhouse, near Glasgow, engineer; W. S. Herriott, 12, Woodrow Road, Pollokshields, engineer; and W. A. Dexter, 7, Knowe Terrace, Shields Road, Pollokshields, Glasgow, engineer. Solicitors: Boots, Edgar and Rylands. Registered office: 45, Scotland Street, Glasgow.

Battery Supplies, Ltd. (213,940).—Private company. Registered May 26th. Capital, £500 in £1 shares. Objects: To acquire the business of electrical engineers carried on as the "Accumulator Charging Service Co." at Cumberland Works, Forest Road, Kew Gardens. The first directors are:—J. Golding, 65, Mortlake Road, Kew Gardens (managing director); G. J. L. Armitage, 27, Burlington Avenue, Kew Gardens; H. P. Middleton, 62, Defoe Avenue, Kew Gardens (chairman); and D. E. Bowden, 62, Defoe Avenue, Kew Gardens. Qualification, £10. Secretary: G. J. L. Armitage. Solicitors: Wright & Son, 9, Gray's Inn Square, W.C.1. Registered office: Cumberland Works, Forest Road, Kew Gardens, Surrey.

Wholesale Electrical Supplies (Salford), Ltd. (213,855).—Private company. Registered May 19th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical goods and wireless apparatus, glassware, &c. The first directors are:—A. E. Jones (chairman), "Clairmont," Gledhow Lane, Chapel Allerton, Leeds; W. Walker, 7, East Parade, Leeds.

Mersey Cable Works, Ltd. (213,994).—Private company. Registered May 27th. Capital, £40,000 in 10,000 7½ per cent. cumulative preference and 30,000 ordinary shares of £1 each. The preference shares take priority in a winding up for arrears of dividend and return of capital. Each share confers one vote, provided that preference shareholders may vote only when their dividends are six months in arrear or when a resolution affecting their rights is proposed. Objects: To carry on the business of manufacturers of electric wires and cables, electrical, magnetic, galvanic and other apparatus, &c. The subscribers (each signing for one ordinary share) are:—Wilfred Stephen Taylor, 9, Calthness Drive, Wallasey, Cheshire, electrical engineer; and Henry Burrows, 5, Harold Street, Egremont, Cheshire, electrical engineer. The first directors, to number not fewer than two nor more than five, are W. S. Taylor (permanent) and two others to be nominated by the subscribers. Qualification, 1,000 ordinary shares. Remuneration as fixed by the company (subject to any agreement). Solicitor: E. B. Driffield, 20, Castle Street, Liverpool. Registered office: Mersey Cable Works, Linacre Lane, Bootle, near Liverpool.

Official Returns of Electrical Companies.

Middlesbrough Steel Tube and Conduit Co., Ltd.—Issue on April 19th, 1926, of £700 debentures, part of a series already registered.

C. F. Palmer (London), Ltd.—Particulars filed on May 17th of £2,000 debentures, authorised January 20th, 1926, charged on 63a, Effra Road, and the company's other assets (subject to first mortgage for £3,000 on the said property), the whole amount being now issued.

Willet & Robinson, Ltd.—Mortgage dated May 3rd, 1926, to secure £300 charged on 16, Beaconsfield Road, Tovil, Maidstone. Holders: Trustees of the Loyal Providence Lodge of the Independent Order of Oddfellows (Manchester Unity) number 6,265.

Runbaken Magneto Co., Ltd.—J. Collier, King's House, King Street West, Manchester, ceased to act as receiver or manager on May 4th, 1926.

Nelson Electric Co., Ltd.—G. S. Hyams, Salisbury House, London Wall, E.C., ceased to act as receiver on May 12th, 1926.

G. H. Robinson, 95a, Chancery Lane, W.C.2, was appointed receiver on May 12th, under powers contained in debenture dated April 20th, 1926.

Burwood (Concessionaires), Ltd.—G. E. McCanlis, of Oxford House, 9-5, Oxford Street, W.1, was appointed receiver and manager on May 11th, 1926, under powers contained in debenture dated January 15th, 1926.

David J. Patton, Ltd.—Particulars filed on May 5th of £1,500 debentures, authorised March 31st, 1926, charged on the company's property, including uncalled capital, the whole amount being now issued.

Ferrow Electrical Co., Ltd.—Satisfaction in full on January 28th, 1926, of debentures dated December 2nd, 1924, securing £1,000. (Notice filed May 19th.)

Cymbal, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated May 4th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

J. Churly Cann, Ltd.—Particulars filed of £800 debentures, authorised May 1st, 1926, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Chambers & Champion, Ltd.—Debenture dated May 14th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. E. Mott, 14, King William Street, E.C.4.

White & Mantle, Ltd. (186,403).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925 (filed March 6th, 1926). 551 shares taken up. £301 paid. £250 considered as paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Siemens Bros. and Co., Ltd.

The annual meeting was held on May 31st, Mr. G. Mure Ritchie presiding. The chairman, in proposing the adoption of the report (*vide* our last issue, p. 804), said that the results could be regarded as satisfactory. They could not have been attained without a sound and progressive policy, adequate capital, good plant, efficient management, and friendly co-operation on the part of employés generally, but those advantages by themselves could not have produced such a balance-sheet. Many other companies in different lines of industry possessed all those advantages in equal degree, but nevertheless showed meagre profits or, indeed, losses. That was because they had lacked the one additional thing needful, which, fortunately, the company had had at reasonable prices—an order book large enough to enable the works to be operated practically at full capacity during the year. In so far as they were a sheltered industry, *i.e.*, contractors to H.M. Government, sharing with other contractors a large amount of work for which they competed keenly, they were at least relieved of competition from foreign countries employing cheaper labour and working longer hours, whose home markets were protected, and whose exports were subsidised both directly and indirectly. That limited protection did not, however, apply to their general Home or export trade. Their relations with their employés continued harmonious and friendly. Except for the strike of wireless operators, when about 25 per cent. of theirs ceased work, they were not affected by labour disputes. The policy of the directors in providing extensions of buildings and plant had been amply justified; indeed, but for the provision made, they would have been in danger of being unable to maintain their manufacturing position. The large volume of orders received in 1924 was well maintained during 1925. In 1925 the Pacific Cable Board resolved to duplicate its cable between Vancouver and Fiji, and the company was successful in securing the order for the section to be laid between Fanning Island and Fiji, a distance of over 2,000 nautical miles. This would be the latest type of high-speed loaded cable, the manufacture of which required special machinery which had been installed in part of the new Woolwich extensions. In 1925 they manufactured the latest balanced and loaded type of submarine telephone cables for communication between the north and south islands of New Zealand, and also for the Japanese Government for laying across the Straits of Tsugaru. Further orders were also received for lead-covered submarine telephone cables, one for extending telephone facilities with Bel-

gium and one for communication with France. The volume of business in underground telephone cables was not quite so large as in 1924, but they had obtained orders which kept the shops fairly well occupied. In the case of power and lighting cables, their full manufacturing facilities were needed to cope with the orders received. Substantial contracts for underground cables for overseas were secured against keen competition. During 1925 there was a steady demand for telephone exchanges, both of the manually-operated and automatic types. Their contracts with H.M. Post Office, now in course of execution, included the public exchanges of Wakefield, Hereford, Colwyn Bay, Llandudno, Brighton and Hove, as well as many other smaller exchanges at Home and abroad. Among overseas contracts might be mentioned automatic exchanges for Pernambuco, Stratford (New Zealand), West Winnipeg and Edmonton (Canada), Newmarket and Albion (Australia), and Kloof (South Africa). The work on the "Western" exchange, in connection with the conversion of the London telephone system, was proceeding satisfactorily, and they expected to commence installation of the automatic exchange before the end of 1926. Their telephone shops during 1925 had been considerably extended in anticipation of the development of the public telephone service at Home, but such development was necessarily dependent on the yearly allocation of Government funds, the expenditure of which, however, in that direction, was truly economic, inasmuch as it was not only revenue-earning, but was also vital to the commercial progress of the country. Their wireless marine apparatus business in 1925 again showed an increased turnover, though expansion was still retarded by the depression in the shipbuilding and shipping industries. Their telegraph section was transferred last year to their associated company, Elliott Brothers (London), Ltd., in order to centralise under one management the business carried on by both companies. Though their overseas business was not yet on a satisfactory scale, they had secured notable increases in some directions, chiefly in South Africa and Australia. Dealing with the future prospects, the chairman said that the value of the unfulfilled orders brought into 1926 was larger than that brought into 1925, but a substantial proportion of the business was of a sporadic character and did not recur every year. Their orders received during 1926 were so far smaller in volume than they were for the equivalent period of last year. He saw no reason, however, to apprehend that the profit for 1926 would be lower than that realised for 1925, provided their manufacturing operations continued without further interruption on the present scale. They would, however, realise that profits depended not only on the favourable conditions he had already indicated, but on continuity of manufacturing operations. When their stokers, transport workers, electricians, and engineers—in all only a small fraction of their employés—suddenly stopped work at the beginning of May the works were brought to a standstill, thousands of employés willing to work became idle, and a very serious loss was inflicted on the company. The existing coal dispute, whilst not so far seriously limiting their activities, would, if it continued, do so. The report was adopted.

British Thomson-Houston Co., Ltd.

The annual meeting was held on May 31st. Mr. H. C. Levis (chairman), who presided, expressed his regret at the death, in January last, of Lord Carmichael, who had been a member of the board since 1917. In moving the adoption of the report (*vide* ELEC. REV., May 14th and 21st, p. 773), Mr. Levis said that during the year under review the general trade conditions of the country had been depressed, and competition had continued to be very keen. The value of the orders received during the year was slightly less than in 1924. On the other hand, the amount invoiced to customers was somewhat greater, but, due to competition, the percentage of profit was lower, and, as a result, the profit for the year had been reduced. The expenditure on buildings and equipment during the year amounted to £289,000. It was the policy of the company to develop its manufacturing facilities as rapidly as business warranted; there were few new commitments made during the year under review, and at present the outstanding amount was quite small. After reviewing the accounts, the chairman called attention to the fact that sundry creditors and retentions amounted to £1,332,333, whereas on the other side of the account sundry debtors amounted to £1,907,384; apparatus, supplies, &c., finished and in process of manufacture, to £1,415,544; and cash at bankers to £342,762, giving quick assets amounting to a total of £3,665,609, so that their financial position was strong. The falling-off in orders for heavy plant for use in this country was very marked during the year, but to some extent that was offset by orders from abroad. It was probable that this falling-off was due to the uncertainty created by the Electricity Bill, as well as by the general trade conditions in the country. That situation had continued up to the present, but as it now seemed to be the policy of the Government to pass the Electricity Bill, the uncertainty should disappear and the flow of orders should be resumed, provided there was an early and definite settlement of the coal dispute, and the general business of the country was not interfered with by further industrial troubles. The Government had not exaggerated the possibilities of growth, and it was to be hoped that the outcome of the proposed legislation would be such that the electrical business could advance unhampered, to meet the demand which existed, and a still further demand which could be created. The immediate effect of the strike upon the operation of the company's works was felt but little, and the percentage of employés who were out at any time was very small. The effect upon the placing of new orders was much more serious, and it was to be feared that the strike and the coal situation would continue to have an adverse effect upon prospective orders. On the other hand, it was probable that matters would ultimately so settle down that they would enjoy a period of industrial peace. It was to be hoped that the revival would not be delayed so long that trade conditions during 1926 would fail to reap any benefits therefrom. The report and accounts were adopted.

Westinghouse Electric and Manufacturing Co.

The report for the year ended March 31st last shows gross earnings of $166,006,800 and a net manufacturing profit of $14,294,862. The gross income was $16,590,225, and the net income available for dividends, &c., $14,122,001. To this was added the surplus brought forward, &c., making $65,404,090. Dividends absorbed $9,474,511 and $51,715,396 was carried forward. The report mentions the operations of the Westinghouse Commercial Investment Co., which was formed to increase the distribution of the company's products by supplementing its system of jobbing agents with its own jobbing houses throughout the United States. The investment company declared a dividend of 6 per cent. for the past year. The Westinghouse Electric International Co., which conducts the company's export business, now has branch offices or distributors in 42 countries and has operating agreements with manufacturing companies in England, Holland, France, Germany and other countries.

Rangoon Electric Tramway and Supply Co., Ltd.

During the past year £117,880 of 4½ per cent. debenture stock was redeemed, leaving £103,778 outstanding; the amount of 5 per cent. debenture stock outstanding at December 31st was £300,000. The gross profit for the year was £169,869, plus £1,250 interest, &c., making £171,119. After providing for debenture interest, &c., including transfers of £20,000 to the reserve for cables and £45,000 to renewals account, there was a net profit of £47,983, to which was added £17,599 brought forward, making £65,582. Preference and interim ordinary dividends absorbed £40,582, and after paying a final dividend of one rupee per ordinary share, free of tax (making one rupee 8 annas for the year), a balance of £20,582 is carried forward. The tramway traffic showed an increase during the year and the electricity supply business also expanded. Considerable extensions were made to the distribution system to meet the growing demand, a 3,000-kW turbo-generator was taken over from the contractors, and two 500-kW rotary converters to take the tramway load were installed.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The report for the past year records a balance of £8,498 at the credit of profit and loss after charging debenture interest, &c., and transferring £900,000 from the general reserve fund. To this is added £656,893, making £665,391. After providing for the interim preference dividend, a balance of £645,391 is to be carried forward. The directors attribute the adverse result to bad trade, heavy production costs, and foreign competition. The company has been unable to obtain business to compensate for the loss of armament orders. Many contracts have shown heavy losses, and it is considered that the greater part of the £900,000 transferred from the reserve will be needed to write these off. The directors have been in consultation with certain of the largest shareholders and the company's bankers, and the present position will be further explained at the annual meeting. The following directors have resigned:—Sir G. H. West, Mr. J. M. Falkner, Sir G. H. Murray, Sir C. L. Otley, and Lord Sydenham.

Aron Electricity Meter, Ltd.

The annual meeting was held on May 27th. Mr. H. Kahn, presiding, said that they had purchased the lease of their old factory building and two adjoining buildings, and the alterations which were being made would equip them with up-to-date factory and office accommodation. The fall in the trading profit was due to the lower profits obtained by the Austrian company, which was caused to a great extent by loss on exchange. Austrian currency was now on a gold basis and the loss should not recur. The outlook for the current year was satisfactory for both the company and the Aron Taximeter Co. Although the Vienna works had had a temporary setback, it was hoped that impending developments would counterbalance that. Altogether the future appeared promising, but the directors intended to pursue their careful policy.

Prospectus.—*Ericsson Telephones, Ltd.*—A prospectus appeared at the beginning of the week inviting subscriptions for an issue at par of 99,980 seven per cent. cumulative preference shares of £1 each in this company, which has heretofore been known as the British L.M. Ericsson Manufacturing Co., Ltd. The issue is being made to provide additional working capital required for handling the largely expanded trade of the company. Record sales figures were experienced for 1924 and 1925, their totals being treble those for 1912, when the last increase in capital was made. Further capital is also necessary to enable the company to commence the manufacture of automatic exchanges and equipment. The ordinary dividend for each of the years 1924 and 1925 was 16 per cent. less income tax. The reserves and undivided profits amount to £227,258, and it is proposed shortly to capitalise part of this sum by applying it in paying up the unissued ordinary shares and issuing the shares so paid up to the existing ordinary shareholders. The list was to close on or before yesterday, June 3rd.

Weston-super-Mare and District Electric Supply Co., Ltd.—The revenue for 1925 was £34,881, and the balance available after deducting expenses, £14,000 for renewals account, &c., and adding £6,356 brought forward, is £18,603. It is proposed to transfer £4,000 to reserve, to pay a dividend of 10 per cent. on the ordinary shares, and to carry forward £6,204.

Electrical Finance and Securities Co., Ltd.—In compliance with the Stock Exchange regulations, this company last week published particulars of its objects, &c. It has an authorised share capital of £100,000 (£76,162 issued) and debenture capital of £20,000 (all issued). The company owns the whole of the capital of the Foots Cray Electricity Supply Co., Ltd., and the Colne Valley Electric Supply Co., Ltd. (which holds a controlling interest in the Northwood Electric Light & Power Co., Ltd.), and the whole of the ordinary shares of the Boston and District Electric Supply Co., Ltd. It has also acquired the share capital of the Lothians Electric Power Co.

Eastern Telegraph Co., Ltd.—The revenue for the year ended December 31st last was £3,473,047, and after deducting expenses there remains a balance of £1,321,125. After providing for taxation, preference stock dividends, debenture interest, &c., and adding £511,317 brought forward, there is an available surplus of £1,555,716, as compared with £1,461,317 for 1924. The directors have placed £500,000 to general reserve and have applied a similar amount from that fund to reduce the expenditure on new cables, renewals, &c. A final dividend of 2½ per cent., free of tax, has been paid (making 10 per cent., tax-free, for the year), and a balance of £555,716 is carried forward. Meeting, June 8th.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

River Plate Electricity Co.—£35,987 ordinary stock.

Application has been made to the Committee to allow the following to be officially quoted:—

Kaministiquia Power Co.—$1,248,500 seven per cent. cumulative preference stock (in shares of $100) and £300,000 first mortgage 25-year five and a-half per cent. sinking fund debenture stock, series "A."

Marconi's Wireless Telegraph Co., Ltd.—At an extraordinary general meeting on May 31st, an extraordinary resolution for the alteration of the articles of association to provide that the British character of the company should be maintained was carried unanimously. Subject to the confirmation of the resolution as a special resolution at a further extraordinary meeting to be held on June 15th, special forms of transfer, which will be supplied to Stock Exchanges, will be necessary on and after June 16th for the transfer of shares in the company.

Merthyr Electric Traction and Lighting Co., Ltd.—The net revenue for 1925 was £27,337 and the balance on working £4,497, as compared with £11,190 in 1924. To this was added £4,929 brought forward, making £16,119. Debenture interest absorbed £2,178, £2,000 is being put to reserve, and after paying the 5 per cent. preference dividend, a balance of £3,730 is carried forward.

Anchor Cable Co., Ltd.—After the general meeting yesterday, an extraordinary meeting was to be held for the purpose of considering resolutions providing for the capitalisation of £130,000 of the undivided profits and the issue of two fully-paid £10 ordinary shares for each £10 ordinary share at present held. A confirmatory meeting is to be held on June 24th.

Lewes and District Electric Supply Co., Ltd.—The surplus on working for the past year was £9,545, and after charging debenture interest, administrative expenses, &c., there remained £3,550, to which was added £3,444 brought forward, making £6,994. After transferring £1,000 to reserve and paying a dividend of 10 per cent. on the ordinary shares, a balance of £3,667 is carried forward.

Electric Construction Co., Ltd.—The directors recommend a final dividend in respect of the year ended March 31st last at the rate of 9 per cent. on the ordinary shares, making 7½ per cent. for the year, and a bonus of 2½ per cent.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors of the company recommend a final dividend on the ordinary shares of 3s. per share, making 4s. per share for the year, as compared with 4s. for the fifteen months ended March 31st, 1925.

Barcelona Traction, Light and Power Co., Ltd.—A dividend of 1¾ per cent. has been declared upon the 7 per cent. non-cumulative participating preference shares.

Glenfield & Kennedy, Ltd.—A final dividend of 6 per cent. has been declared on the ordinary shares, making 10 per cent. for the year.

Erinoid, Ltd.—An interim dividend of 4 per cent. has been declared.

Stocks and Shares.

MONDAY EVENING.

ALTHOUGH at the time of writing on Monday evening, nothing has been settled definitely in regard to the termination of the miners' lock-out, this is making little difference to the firmness that prevails in most Stock Exchange markets, nor is it having a noticeable effect in any department except those sections which are most intimately connected with the coal industry. It might have been assumed that, having regard to the grave issues involved, electricity supply shares would have declined, but the reverse is the case, and in several shares improvements have taken place during the past few days.

Railway stocks are, of course, inclined to be dull, although, with regard to the electric services, prices are steady, holding their rises of last week. Central London Assented ordinary and Underground Electric Income Bonds are both a point to the good. It is doubtful whether there has ever been, on any previous occasion, an industrial disturbance of magnitude comparable to the present miners' lock-out which has exercised so little influence over Stock Exchange prices. Moreover, business in a good many of the markets, if not exactly brisk, is tolerably well maintained, and it may be said that racing has had more to do with interference of ordinary business this week than the coal crisis.

Rises in electricity supply shares are divided between Bournemouth and Poole, City of London, Metropolitan and Westminsters. Electric Supply Corporations are 1/16 down at 31s. 3d., and North Metropolitan Electric preference eased off to 22s. Midland Counties have recovered to 20s. 6d., the Provincial group as a whole being distinctly firm. Edmundsons regained their previous slight decline.

The market for cable and electrical construction shares is a little quieter after the remarkable strength which it showed last week. All the rises then scored have been retained, and fresh gains of half-a-crown accrued to Henleys and Johnson and Phillips. Henleys have declared a final dividend of 3s. per share, making the dividend 20 per cent., as compared with 16 per cent. in the previous twelve months. As, however, the figures last year covered 15 months, precise comparison with the figures just presented, for twelve months, is liable to be confusing.

Siemens strengthened to 31s. 3d. Callenders hold their rise at £4 per share. The new issue is expected to be made on Thursday in this week. Babcocks keep good at 52s., and General Electrics are 1s. up at 30s. 9d.: the "B" preference at 24s. 6d. have gained a trifle. The buying has slackened to some extent in this section, on the assumption that current prices are fairly well valued, although at the same time it is known that a wide circle of prospective buyers watches closely for any opportunity of picking up stock which looks cheap. Electric Constructions are unchanged at 32s. 6d. upon repetition of the 10 per cent. dividend and bonus, less tax, for the year.

Aron shares are a shade harder at 16s. 3d., as a result of the meeting at which its chairman stated: "I think we may say we are going steadily ahead." It will be well when the company is able to obtain from the Government a satisfactory settlement of the terms upon which the company's income tax ought to be calculated. There is a palpable hardship imposed upon any company that has to keep in hand a considerable sum of money against Government claims which, to the ordinary business man, it would appear obvious should have been settled long ago. The same conditions apply to Siemens, and it seems surprising that the Inland Revenue should be so dilatory over matters of tax collection.

The Eastern Telegraph Company reports an increased profit, the figures for last year being nearly a million and a half. Receipts and expenses both expanded. The allocations are liberal and the company's position is stronger than ever. The dividend is maintained at 10 per cent. free of tax for the year. No change has occurred in the list of Eastern cable stocks. Anglo-American Telegraph preferred strengthened to 102, upon that investment demand which is now so evident in most parts of the House. The American Telephone & Telegraph Company is about to offer next month to its stockholders, new shares at par ($100) in the proportion of one new share for each six shares at present held. The price of the existing stock is 154, so that there is a useful bonus involved in the distribution. This week there have been offered 99,960 7 per cent. cumulative preference shares of £1 each at par in Ericsson Telephones, Ltd.

Brazilian Tractions are at last in three figures again, being quoted at 100. The preferred strengthened to 106. Shawinigan Water has risen 5 points to 188. Montreal Light & Power shares are better at 232½. Anglo-American Tramways Second preference rose to 2¾. Mexican Utilities show a better disposition. In the English group, the excellent British Electric Traction dividend led to a further advance, to 111, in the preference stock: the ordinary holds its last week's gain of 5, at 132½.

Marconis, while nominally unchanged, are a better market at 24s. 6d. The Swedish Telegraph Board has recently concluded a contract with the company in respect of transmission equipment for Sweden's new and extensive broadcasting station. Engineering shares remain firm, although a deplorable report from Armstrong Whitworth was not conducive to cheerfulness in this group. The Armstrong Company transfers £900,000 from general reserve, and even then the profit for last year is but £8,500, compared with £505,000 a year ago, when no assistance was taken from the reserve. The price of the ordinary shares has dropped from 9s. to 6s. 6d. All the preference issues have to go dividendless, as previously announced. Rubber shares lack interest, the price of the raw material being about 1s. 9¼d. per lb.

"A New Fuel Industry" is the legend that appears on the prospectus of the Chalk Fuel, Power-Gas and Bye-Products Corporation, Ltd. This concern is the latest of the series in which Sir Charles B. H. Soame and Major Brigden are two of the shining lights on the board. "Fancy burning chalk——!" exclaims one indignant reader: "it were easier to eat coke—to advantage." It is only necessary to add that the prospectus is so bare of the ordinary information which investors should require before parting with their money, that the issue should be left alone by anyone with regard for his capital. The prospectus claims that chalk will burn. So will paper.

Share List of Electrical Companies.

	Nom.	Dividend. £1924	1925.	Price May 31 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	57/-	+1/8	4 16 7
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	47/-	+1/8	6 7 8
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15		59/6	—	5 0 10
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	23/6	+6d.	5 19 2
do. 7% Pref.	1		7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	31/3	—1/8	6 8 0
Kensington Ordinary	5	15	15	19½	—	5 11 1
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5½	—	5 11 7
Metropolitan	1	11	11	37/-	+1/8	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/6	+6d.	5 17 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—£d.	5 9 1
St. James' and Pall Mall	5	17½	17½	16½	—	5 8 6
South London	1	15	15	2½	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	7	1/-	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44/6	+1/8	6 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—	7 18 10
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	69	+1	5 15 11
Metropolitan	,,	5	5	65½	—	7 12 8
do. District	,,	5½	5½	68	—	8 12 1
Underground Electric Ordinary	10	Nil	Nil	3½	—	Nil
do. do. "A"	1/-	Nil	Nil	11/8	—	Nil
do. do. Income	Bonds	6	6	100	+1	*6 0 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	+½	5 17 8
do. Def.	,,	1½	1½	28½	—	6 6 4
Automatic Telephone	1	8	6	2½	—	4 0 0
Chili Telephone	5	6	5	6⅞	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6½	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 12 8
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	22	20	28	—	7 2 10
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi	1	10	10	1⅛	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	43/9	+1/8	*5 9 7
United R. Plate Tel.	5	8	8	7½	—	*5 2 7
Western Telegraph	10	10	10	17½	—	*5 15 11
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	8 16 0
do. do. 2nd Pref.	5	6	6	2⅞	+1/8	10 18 2
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord.	,,	6	7	132½	—	5 5 8
do. do. 6% Pref.	,,	6	6	111	+1	5 8 1
Brazil Traction	100	4	5	100	+2	5 0 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 17 0
do. do. Preferred	,,	9/-	12/9	109½	—	*5 16 0
do. do. Deferred	,,	12/6	8	131	—1	*6 2 2
do. do. Deb.	,,	4½	4½	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	49	—	8 3 4
Mexico Trams, 5% Bonds	—	5	5	65½	—	7 12 6
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	73½	—	Nil
do. 1st Bonds	—	5	5	71½	+1	6 19 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	13	52/-	—	*5 0 0
British Aluminium Ord.	1	5	10	2½	—	5 0 0
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅞	—	4 14 1
Brush Ord.	1	10	10	27/-	—	7 5 6
Callenders	1	15	15	4	—	3 15 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	—	4 17 0
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 8 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	30/9	+1/-	4 17 9
Henley	1	16	20	4	+⅛	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	3½	+⅛	5 15 8
Met.-Vickers Ord.	1	8	8	23/-	—	6 8 0
do. Pref.	2	8	8	2⅝	—	6 14 9
Siemens Ord.	1	7½	7½	31/3	+9d.	4 16 0
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price June 1st.	Inc. or dec. Since April 27th.
a Acid, Oxalic per lb.	5¾d.	...
a Ammoniac, Sal per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ,,	...	...
a Borax ,,	£25	...
a Copper Sulphate ,,	£25 10s.	...
a Potash, Chlorate per lb.	4d. to 4½d.	...
a ,, Perchlorate ,,	5½d.	...
a Shellac per cwt.	£15 15s.	...
a Sulphur, Commercial ,,	£9 10s.	...
a ,, Roll ,,	£9 10s.	...
a Soda, Chlorate per lb.	3¼d. to 3½d.	...
a ,, Crystals per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots per ton.	£120 to £125	...
b ,, Wire per lb.	1/9 to 2/6*	...
b ,, Sheet ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net.	£240	£5 dec.
Grade II ,, ,,	£168	£3 dec.
Grade III ,, ,,	£92	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ,,	11½d. to 1/-	...
c ,, Wire, basis ,,	9½d.	...
c Copper Tubes (solid drawn) ,,	1/0½	...
c ,, Bars (best selected) per ton.	£90	...
c ,, Sheet ,,	£90	...
c ,, Rod ,,	£90	...
d ,, (Electrolytic) Bars ,,	£64 10s.	10/- dec.
d ,, ,, Sheets ,,	£144 10s.	...
d ,, ,, Wire Rods ,,	£74 10s.	10/- dec.
d ,, ,, H.C. Wire per lb.	9⅝d.	¼d. dec.
f Ebonite Rod ,,	2/3 to 2/6	...
f ,, Sheet ,,	2/3 to 2/6	...
n German Silver Wire ,,	2/2	...
h Gutta-percha, fine ,,	8/-	...
h India-rubber, Para fine ,,	1/8½	1½d. dec.
l Iron Pig (Cleveland No. 3.) per ton.	72/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ,,	£30 10s.	5s. inc.
g Mercury ,,	£15 10s.	5s. inc.
e Mica (in original cases) small per lb.	3d. to 1l/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire ,,	1/3½	½d. dec.
o Platinum per oz.	£23 10s.	...
d Silicium Bronze Wire per lb.	11½d.	½d. dec.
r Steel, Magnet, in bars ,,	7½d.	½d. dec.
n Tin, Block (English) per ton.	£264 5s. to £266 5s.	15/- to 45/- dec.
n ,, Wire, Nos. 1 to 16 per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

An International Congress of Producers and Distributors of Electrical Energy.—This congress is to be held in Rome in September next. The principal subjects to be dealt with include pulverised coal as boiler fuel, the gasification of coal and lignite for electricity production, the employment of steam at high pressures and temperatures in central stations, the position of hydro-electric development in different countries, tele-communication between power plants and distribution stations, &c.

The I.M.E.A. Convention.—We understand that, as far as possible, the programme of the Convention outlined in our issue of April 2nd, p. 545, will be carried out without change at Glasgow, though under the circumstances slight departures from it may be unavoidable.

The exhibition of electrical appliances and novelties will be held at the McLellan Galleries, Sauchiehall Street, a space of about 10,000 sq. ft. being available; twenty-four manufacturers will be represented, besides the Electricity Department of the Corporation and the E.L.M.A. Lighting Service Bureau. The British Electrical Development Association and the Electrical Association for Women will also take part in it. The exhibits will cover not only, as usual, cooking, heating and lighting apparatus, but also a much wider range of appliances of interest to engineers, such as heat storage apparatus, industrial heating appliances, thermostats, meters, new wiring methods, &c. The exhibition will be open from 10 a.m. to 9 p.m. every day during the week; on Monday only members of the Convention will be admitted, but on other days certain hours will be allotted to the general public.

Exports and Imports of Electrical Goods and Machinery in April, 1926.

It is unfortunate at a time when we need every encouragement to make up for the time lost last month, to say nothing of the effects of the coal dispute, the origin of it all, that our statistics of foreign electrical trade during April make such a bad showing, both against the March figures and those of April, 1925. The position cannot be attributed to the incidence of the Easter holidays, for Easter occurred in April last year, and yet our export total is over £400,000 smaller than in April, 1925. It may be that there was a slowing-down in anticipation of the industrial troubles, which were fully realised last month, but whatever the reason the fact remains that our exports declined for the third time this year.

The fall of over £280,000 in the total value of exported electrical goods followed a decline of £99,275 in March, although in the latter case the figure was above that for the equivalent month of last year, whereas April's total shows a serious falling-off from the 1925 total. The decline was spread over practically all classes, the only exceptions being "other motors and generators," switchboards (not telegraph or telephone), and telegraph and telephone instruments and apparatus. The most serious fall occurred in the exports of insulated wires and cables which lost over a third of their March value. This was accompanied by large decreases in the other two cable sections—submarine and non-submarine telegraph and telephone cables. Unenumerated electrical machinery and traction motors were affected heavily, and unenumerated electrical goods and apparatus was another item which "slumped." The other decreases were of comparatively small importance. As a result of the large fall in electrical exports during April, the total for the first four months of the year is about £560,000 behind the figure for the equivalent period of 1925. The May total is, naturally, certain to be smaller, but there still remain seven months in which the exports have time to recuperate. We may observe as an extenuating circumstance that April, 1925, was a very good month indeed, in which exports rose by over a quarter of a million above the comparative totals.

Turning to the import section it will be seen that although there was a net decline of £4,100 as compared with March, the increases and decreases were fairly evenly balanced. The largest alteration was a rise of £18,000 in the imports of unenumerated electrical goods and apparatus, which, by the way, accompanied a large fall in exports of the same class. Insulated wires and cables showed the greatest decrease (about £15,000); none of the other items showed large alterations in value. As compared with the April, 1925, figures there was a large decrease in imports, but this was mainly due to the fall in the value of imported telegraph and telephone instruments and apparatus. On the other hand, the figures for batteries and accumulators and unenumerated electrical machinery were well up as compared with those for April, 1925. Imports for the four months also show a substantial decrease in comparison with the corresponding period of last year.

The comparatively unimportant re-export section also has decreases to record both in comparison with the preceding month and with April last year. As compared with March the decrease was fairly general, there being only two small increases. This section again shows a diminution for the first four months of the year as against January-April, 1925.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.	Electrical imports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.	Electrical re-exports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.
Electrical goods and apparatus (unenumerated)	£149,458	− £41,697	+ £3,401	£106,877	+ £18,011	+ £5,776	£8,162	+ £856	+ £3,077
Insulated wires and cables ...	183,127	− 109,742	− 8,740	47,534	− 14,987	+ 1,798	1,074	− 900	− 651
Glow lamps	35,857	− 5,178	− 4,896	17,464	− 4,615	− 12,103	532	− 575	+ 1
Arc lamps and parts	730	− 164	− 6,250	742	− 386	− 199	7	− 1,397	− 1,721
Batteries and accumulators ...	58,224	− 9,373	− 16,989	38,468	+ 1,489	+ 10,086	2,122	− 80	+ 290
Meters and instruments ...	32,415	− 3,781	− 1,777	19,331	− 4,255	− 4,620	787	− 885	+ 329
Carbons	881	− 390	− 1,526	10,864	+ 1,983	+ 2,243	51	− 134	− 55
Electrical Machinery—									
Electrical machinery (unenumerated)	213,017	− 59,623	− 100,333	111,404	− 5,751	+ 13,306	7,960	− 3,798	+ 2,541
Railway and tramway motors	22,344	− 21,930	− 16,013	—	—	—	—	—	—
Other motors and generators ...	177,501	+ 10,002	+ 25,547	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	9,491	+ 6,083	+ 2,329	26	+ 22	− 125	—	− 18	− 8
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	65,772	− 21,135	+ 22,038	12,389	+ 2,568	− 2,246	60	+ 38	− 1
Submarine telegraph and telephone cable	12,157	− 37,444	− 278,195	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	238,140	+ 14,219	− 24,963	35,911	+ 1,821	− 66,861	4,346	− 321	− 6,907
Totals	£1,199,114	− £280,153	− £406,367	£401,010	− £4,100	− £52,945	£25,104	− £7,214	− £3,105
		Exports.			Imports.			Re-exports.	
Decreases for four months of 1926 ...		− £559,575			− £280,653			− £12,210	

United States Electrical Exports.—The value of electrical goods exported from the United States during March reached a high level, totalling $8,586,252. Comparing the statistics with those for March, 1925, it is seen that there was a large decrease in the value of exported generators (except small lighting sets) and the exports of mining and industrial locomotives also declined. On the other hand, the exports of railway motors showed a very large increase, as did also transformers, converters and transmission and distribution apparatus. With the exception of the fractional-h.p. types all classes of motors recorded increases, particularly those from 1 to 200 h.p., which were nearly doubled in value. Domestic apparatus exports were larger and radio goods, including batteries, increased by $286,000.

Manufacturing in Belgium.—The report of the Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels) states that although the industrial reorganisation of the undertaking was methodically continued in 1925 and the volume of orders received was considerably larger than in the preceding year, the accounts only show profits of 2,804,000 fr., which just cover the financial charges and permit of some necessary provision for depreciation. The company's inability to derive full benefit from the progress made in its various branches is said to be due to a labour dispute which lasted from July 2nd to the beginning of September. The result was that it was impossible to complete and invoice important orders which ought to have been brought into account last year. It is stated that the increase in the orders received was due to the continued development of the export trade.

The Frequency Characteristics of Telephone Systems.

The Apparatus and Methods used for Testing.

By B. S. COHEN, A.M.I.E.E., A. J. ALDRIDGE, A.M.I.E.E., and W. WEST, B.A.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper demonstrates the value of the frequency-amplitude characteristics of telephone systems and apparatus in determining the transmission efficiency, including volume and articulation efficiency. The audio-frequency ranges of importance for speech and music are considered and methods are described for the direct and indirect production of constant acoustic output over the audio range, and the calibration of acoustic measuring instruments is dealt with. Next, the production of electrical energy of constant value over the required frequency range is treated of and a special form of oscillator, together with associated apparatus for the direct recording of frequency characteristics, is outlined.

A thermionic oscillator can be arranged to cover all the requirements, and during preliminary work the use of two ultra-audio oscillators heterodyning with one another appeared to be the method which could be usefully applied to the present problem. If an oscillator working at a frequency of, say, 25,000 cycles per sec. is coupled loosely with another which is caused to oscillate at any point between 25,000 and 30,000 cycles, the fundamental of each oscillator will be inaudible, but a "beat" frequency will be introduced varying between 0 and 5,000 cycles. No difficulty is experienced in obtaining the "beat" frequency, but considerable difficulties are encountered in rendering it sinusoidal in shape and constant in value, and it is essential to secure these qualities if the maximum use and convenience are to be obtained from the instrument.

At frequencies of 25,000 cycles a change of frequency of 5,000 cycles can be effected by changing the oscillator capacity by a small amount, which can be covered in a 180 deg. movement of a small air condenser. This means that the whole range of audio frequencies normally required (say 0 to 5,000 cycles) can be obtained by the rotation through 180 deg. of a single dial. The range can, of course, be altered by modifying the ultra-audio oscillators, or the small variable condenser.

The general method of operation is to cause the oscillator to actuate the apparatus under investigation, the result of this actuation being measured as a galvanometer deflection recorded photographically on paper on a drum which is rotated with the variable air condenser used to obtain the variation in frequency. This method of operation required the use of receivers or transmitters having equal outputs over the range of frequencies under consideration. For example, in examining a transmitter for resonance it would be actuated by a special non-resonant receiver operated from the oscillator, and the a.c. output would be rectified and passed through a d.c. galvanometer, the deflections of which would be recorded, as described above. A receiver would be tested by operating it from the oscillator, and causing it to actuate a non-resonant transmitter. Non-acoustic apparatus, such as transformers, induction coils, &c., are examined by current or voltage measurements.

In designing the apparatus at present in use the following requirements have been covered:—(1) The range of audio frequencies covered by the rotation of the dial of the operating variable condenser through 180 deg. is from 0 to 5,000 cycles. (2) The output at all frequencies within the range is practically sinusoidal. (3) The output voltage is practically constant for all frequencies within the range. (4) The high frequencies of the oscillators are eliminated before reaching the audio-frequency output, in order to prevent interference with current measurements on the galvanometer.

The circuit diagram of the heterodyne oscillator used by the authors is shown in fig. 1, which illustrates also the method employed for taking photographic records. Each high-frequency oscillator circuit comprises a grid coil L_1 of 50,000 μH, coupled to a plate coil L_2 of 20,000 μH, tuned by a fixed condenser C_1 (about 0.001 μF). A variable condenser C_2 with a maximum value of 0.0005 μF is connected in parallel with one of the condensers C_1, to cover a frequency range of about 5,000 cycles. Output coils L_3 of 10,000 μH introduce the high frequencies from each oscillator into the high-frequency amplifying valves V_3, which serve to prevent, as far as possible, interaction between the two oscillators; each oscillator, with its associated high-frequency amplifier, is also enclosed in an iron box. The high frequencies are taken by resistance-capacity coupling and a common input lead to the grid of the detector valve V_4, which operates on the anode rectification principle. In the plate circuit of this valve is a low-pass filter having a cut-off at about 20,000 cycles, serving to reduce to a negligible quantity the high frequencies in the audio-frequency output; moreover, it provides (for the high frequencies) a sufficiently low-impedance path from the plate to the filament to ensure efficient operation of the detector valve. Two stages of resistance-capacity coupling bring the audio-frequencies to the output transformer of the set.

With an ordinary-type output transformer, the output/frequency characteristic was found to be unsatisfactory, the output increasing too slowly as the frequency was raised from zero, and falling off again at the higher frequencies. Output transformers for the heterodyne oscillator are accordingly built on 1-in. square cores of Stalloy stampings, the windings consisting of a number of interleaved wave-wound slab coils. It is, of course, essential that the secondary winding should terminate with a non-reactive load, a generally useful value for which is 800 ohms, through which a current of about 10 mA is obtainable. When more current is required this load may be increased to, say, 100 ohms, and the transformer ratio and resistance of the secondary winding may conveniently be adjusted by joining in parallel certain of the slab coils.

Whilst such a transformer gives a satisfactory output at the low frequencies, there is a tendency for the output to fall off at the higher frequencies. In order, therefore, to flatten out the characteristic, the output at the lower frequencies is cut down to the same value as that obtainable at the high frequencies. To effect this, a 0.2 henry air-cored inductance L_4 was inserted in the anode circuit of the first audio amplifying valve in series with a variable non-inductive resistance R_4, the impedance of this circuit thus having a rising characteristic with frequency.

The method of measurement is illustrated in fig. 1. A rectifying valve V_5 has in circuit a quick-moving reflecting galvanometer G, the spot of light from which falls on photographic paper wound round the drum of the condenser camera C_3 (V_5 is shown as a diode rectifier; as a general rule, however, it is preferred to use a triode with anode rectification.)

For many purposes it is convenient to substitute for the condenser camera a pair of variable condensers in parallel, one of, say, one-half the capacity of the other, and one equipped with a vernier that can be adjusted so that the beat frequency is zero when both condensers are set at zero. One condenser will then give half the available frequency range of the oscillator for a 180 deg. rotation of its dial, whilst the whole frequency range is obtainable from the other condenser; the dials of both condensers may be engraved in frequencies.

The wave-form impurity is almost entirely due to a second harmonic, as was tested by tuning out first the fundamental and then the second harmonic. From a measurement (with the impure wave-form) of the capacity of a condenser, the impurity did not exceed 5 per cent. of the fundamental.

A variable condenser (about 0.001 μF maximum) shunted across the input to the detector valve is a useful addition to the heterodyne oscillator, for as the value of this capacity is increased, so the output from the oscillator is reduced and, at the same time, the wave-form is improved. Hence, when-

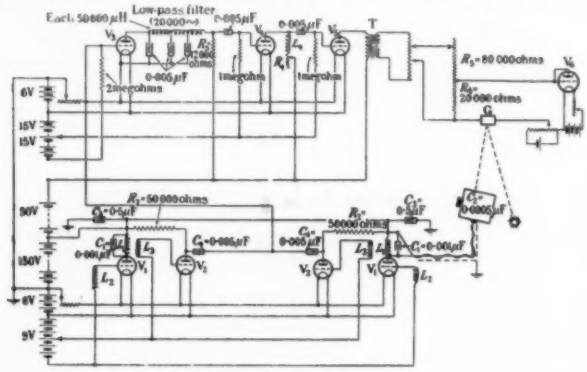

Fig. 1.—Complete Heterodyne Oscillator.

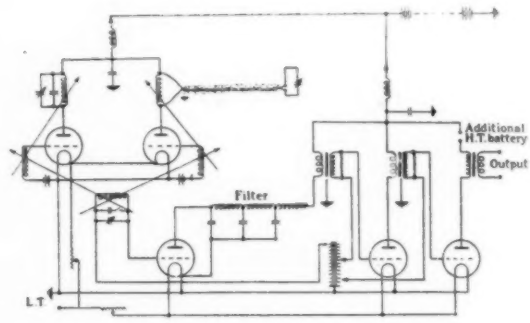

Fig. 2.—Portable Heterodyne Oscillator.

ever the maximum output from the oscillator is not required, a suitable adjustment of this capacity is made in order to obtain the best wave-form available. The operation of the condenser in this respect is two-fold, by reducing the magnitudes of the alternating voltages in the audio-frequency amplifier it lessens the percentage of harmonics generated therein, and by providing, in the plate circuits of the high-frequency amplifying valves, an impedance, which is lower for the harmonics than for the fundamental, it tends to purify the wave-form of the high frequencies introduced into the detector valve.

The general method preferred for making frequency characteristic tests with the heterodyne oscillator is to introduce a constant voltage from the oscillator across a non-reactive resistance, which forms a part of the normal input connections to the apparatus under test, and to record the voltage output, with the circuit terminated by an impedance equivalent to that used under working conditions. This method involves the use of a suitable non-reactive attenuator run between the output transformer of the oscillator and the apparatus under test, serving to maintain a non-reactive load on the transformer and also to retain the normal impedance, on the input side of the apparatus under test, uninfluenced by the presence of the transformer.

A smaller and more portable pattern of heterodyne oscillator has also been constructed. The arrangement is somewhat different from that of the large instrument, and the circuit is shown in fig. 2. It will be observed that no high-frequency amplifier stages are used in conjunction with the oscillators.

The concluding part of the paper contains the frequency characteristics of each part of the apparatus used in a telephone connection, and also of audio-frequency amplifiers and loud-speakers. For the purely electrical portions of the circuit, current or voltage characteristics are added, whilst for such apparatus as transmitters and receivers the characteristics are given in terms of acoustic pressures on the diaphragm. The characteristics of some commercial types of granular transmitters are outlined, then under the heading of receivers will be found the characteristics of both the Bell pattern and some typical loud-speakers of the horn and hornless types. Particulars are given of apparatus designed to measure diaphragm motion, some results obtained by an aural balancing method being included.

In the section dealing with lines will be found characteristics of unloaded open wires and cables and loaded cables. An impedance/frequency characteristic is also given and its application to fault location illustrated. Some notes on telephone line repeater characteristics are followed by a section dealing with exchange cord circuits and subscriber's instrument characteristics. Under audio-frequency amplifiers some typical inter-valve transformers of the type used for broadcast reception are characterised, and an extension is given of the theory of this type of transformer covering the effects of resistance and capacity loads.

Finally, it will be obvious that it is impossible to deal adequately in one paper with the frequency characteristics of all apparatus used for the transmission of speech and music, and little attempt has been made to do more than indicate the results obtained with typical apparatus of each of the various classes. The few characteristics given indicate the highly resonant output of commercial telephone receivers and transmitters and the extent to which the volume efficiency must depend upon resonance. The characteristics show that there is considerable room for improvement in the case of receivers and transmitters, and it is claimed that the apparatus described in the paper forms a ready means of enabling the effects of change in construction and design to be conveniently observed, measured, and recorded.

Discussion in London.

During the discussion that followed the reading of an abstract of the paper by Mr. B. S. Cohen, it was pointed out that the paper differed markedly from that which the authors had previously presented. Telephone devices must be operative over a band of frequencies, and accordingly any single-frequency method of testing them was of no use by itself. The paper marked the advance which had been made in five years by the Post Office research staff, who not only knew what was being done, but also carried out original research. The authors made no reference to the "transmission unit."

The great strides made by weak-current engineers was due to the development of the thermionic valve; at the City and Guilds Engineering College attempts had been made to obtain similar results to those claimed by the authors by means of an oscillator very like that shown in fig. 1, but without much success. Whilst the values of various coils, condensers, resistances, and voltages had been carefully indicated in the diagram, the valves used were simply designated v_1, v_2, &c., and the authors had not explained how they had managed to obtain their results, nor how they were able to use a common high-voltage battery. Scientifically accurate pictures needed to be very carefully interpreted acoustically, for the ear very quickly became saturated; for broadcast radio-telephony the full picture was required, for ordinary telephony an outline sufficed, whilst telegraphy conveyed a cubist impression which needed expert interpretation.

The employment of a heterodyne oscillator was a question of the degree of accuracy and constancy permissible, as distortion was introduced by the position of the listener's head. The Western Electric Co., in America, had carried out similar experiments and obtained like results. A gramophone and records, in the construction of which telephone principles had been applied, were exhibited; the machine and records could be calibrated and, therefore, the total output of the machine was known. As a producer of ascertained sound intensity its demonstrator claimed such a machine to be a better proposition than the so-called simple oscillator with its several valves, batteries, &c.

Much research had been carried out, and it was hoped that more of it would be translated into practical results, *i.e.*, better telephone lines and instruments. Many questions were put to the authors, and in reply to some of them Mr. A. J. Aldridge remarked that no real difficulty had been experienced in using the oscillator shown in fig. 1, but the Post Office authorities had no intention of placing an instrument of that kind on the market.

Insulating Compound Tests.

New Belgian Regulations for Cable Box Insulation.

THE Comité Electrotechnique Belge has recently issued a new series of conditions for tests of insulating compound intended for the filling of electricity supply cable boxes. A distinction is made between the material, M.O.B., used in boxes located in positions subject to normal temperatures, and M.E.C.B. for use where high temperatures are met with. The temperature at which the material flows must not be lower than 40 deg. C. for M.O.B. and 60 deg. C. for M.E.C.B., when tested by the Kraemer-Sarnow method, which determines the temperature at which 5 grammes of mercury pass through a 5-mm. layer of insulating material contained in a glass test tube of the same diameter.

The apparatus is prepared by cutting a glass tube of a certain length and of a diameter of 5 mm. Inside the tube is placed a glass disk arranged to slide exactly within it, and wetted so that the test piece of material shall not adhere to it. After pouring the compound into the tube, when everything is cold the glass disk is removed, and the 5 grammes of mercury

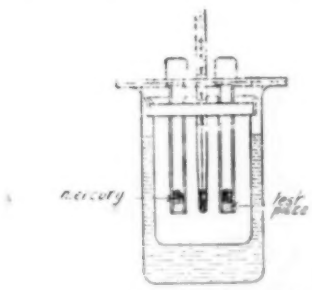

Fig. 1.—Temperature Test.

inserted on the top of the test piece. The tube is then fixed in a test bowl placed in a heated bath, fig. 1. The temperature at which the mercury passes through the insulating material is recorded by the adjacent thermometer.

At 20 deg. C. the insulating material is required to be non-breakable, although capable of being scraped by the finger nail, and when melted at 100 deg. C. it should be perfectly homogeneous and quite free from lumps.

The material must also be capable of adhering to metal, and to ensure that it possesses this property it is tested by flowing it, when melted at 100 deg. C., on to a 0.3-mm. sheet of tin set in a rectangular frame, 130 by 180 mm., made of 3-mm. sheet metal. The layer of compound is levelled off and allowed to cool to 15 deg. C. Then with the material on the upper side, the tin sheet should be capable of being bent in all directions, without the material becoming detached from the tin, although splits or cracks in the surface are permissible.

The minimum dielectric rigidity is laid down to be 25,000 volts effective per mm., the voltage curve to be practically sinusoidal and the frequency 50 periods per sec. The dielectric rigidity test is made by flowing on a flat circular horizontal plate, heated to a temperature of about 100 deg. C., a layer of the melted material at least 250 mm. in diameter and from 1 to 1.5 mm. in thickness. The plate and layer are then put aside until the former is quite cold and the material thoroughly hardened. The testing appliance consists of a lower electrode of at least 250 mm. diameter, and an upper electrode, of the shape shown in fig. 2, weighing 1 kg. and having a surface contact with the material of 25 sq. cm., and an outside diameter of 110 mm. By measuring the thickness of the test disk at a distance of 5 or 6 mm. from the pierced crater, it is possible to deduce, by a simple proportional calculation, the rigidity per mm. in terms of breakdown pressure.

The contraction of the material at temperatures from 150 deg. C. to 15 deg. C. should not, during test, exceed 7.5 per cent. This test requires a graduated metallic recipient in which a sample of the material is first heated to 150 deg. C. and then allowed to cool to 15 deg. C. Oil is then added to the 150 deg. C. level, so that the degree of contraction can readily be determined. There should be no sign of bubbles when the material is kept heated up to 200 deg. C. for five hours. Finally, the tests for acidity and alkalinity provide that the compound when placed in boiling water should impart

neither alkalinity nor acidity to the liquid, nor at temperatures below 150 deg. C. should it have any attacking effect on metal, while when dissolved in sulphide of carbon the material should not leave a residue of more than 2 per cent.

In using insulating material in cable boxes, the Comité points out that the flow of the material should only take place after the boxes have been thoroughly cleaned. When filling the boxes the material should be at about 125 deg. C. in order that it should neither burn the insulators nor solidify before it has penetrated into every part, so that the formation of air

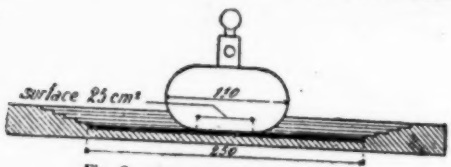

Fig. 2.—Apparatus for Puncture Test.

pockets is prevented. The material should be poured slowly, a little at a time, until the box is filled. Insulating material which has been kept heated a long time is unsuitable for successful use.

Our Mr. Smith.

By a Tenderfoot.

OUT of the cold, drizzling rain and the gloom of a small manufacturing town, into the comparative warmth and light of the hotel, comes a tired, travel-stained person carrying a bag. The bag is small, but tightly packed drawings, photos and catalogues, plus a slide rule and a few other essentials, seem to increase in weight during the day and finally turn the scale at about .25 lb. per cubic inch. Probably the weight varies according to some such formula as $w=w+wkt$, where w is the weight at the beginning of the day, k a constant depending on the weather and the state of trade, and t the time in hours which has elapsed since the last meal.

The figure with the bag collects an envelope, and finds inside a copy of a letter sent from his head office to a prospective customer—sorry, client—in a particularly obnoxious town 80 miles away on a branch line. The letter reads:—

"We thank you for your letter of the 2nd inst. Our Mr. Smith is in your district, and we have asked him to call on you at the time you suggest, to discuss our quotation of the 23rd ulto."

At the bottom is a penned note, "10.30 Friday morning. Hope you can manage—we must get in with these people."

Mr. Smith, for the transporter of the bag is none other, murmurs a little prayer, chalks up 6.30 on the call board, and departs to extract food after "service hours" out of an unwilling kitchen staff.

The morning fulfils the promise of the previous night; rain in parts, further outlook unsettled. Mr. Smith, his brain cleared by a little blood-letting—why are hotel bedrooms built so that a shaving mirror can never be suspended in a favourable position?—reflects that he has to be 80 miles away by 10.30, and in the afternoon is due to investigate some trouble on plant installed some miles from a station on another branch line.

The breakfast is not good. Doubtless the cook is a slow starter, and serves up delicious bacon after a few trial runs, but Mr. Smith always seems to be down in time for a trial run.

We will not follow our friend's fortunes through the day. The branch line was typically branch, the prospective client disappointing, the plant trouble something which any ordinary engineer would have cured without worrying the makers. Lunch, taken late, was a respite from rain, but as a meal left much to be desired.

After a long (time, not distance) and foodless journey, our Mr. Smith seeks a haven for the night. Tucked in his little bed, in a room near the lift and overlooking the tram terminus, he reviews the happenings of the day; he has not "got in" with the prospective client; the trouble which he cured was due to unskilled handling of the plant, and he will not receive any plaudits from a delighted works for saving the visit of a proper trouble-man; he has left his slide-rule somewhere around the engine room, and if not broken by now it will certainly be damaged in the post; he must have a haircut to-morrow, but doesn't quite see how or when.

A few hours later, at the works, a worried manager is scanning an attenuated list of orders and cursing the sales staff, ignoring the effect of trade depression, competition, seasonal slackness and other factors. At a desk in a neighbouring office an engineer gazes out of the window at a blue sky and wishes he had an outside job, instead of being chained to a desk in an unbeautiful works.

At about the same time our Mr. Smith is sitting at a way-side junction watching the back of his train vanish into the distance and murmuring, perhaps, "Now more than ever seems it meet to die, to cease upon the midnight with no pain." A thin rain is falling and there is no refreshment buffet.

There is a moral for us all in this, somewhere.

The Electrical Imports of Egypt.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1925 is taken from the recently-issued trade statistics. The figures for 1924 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1924. £E	1925. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	147,000	165,000	+ 18,000
From Great Britain	29,000	31,000	+ 2,000
„ United States	13,000	6,000	− 7,000
„ France	46,000	52,000	+ 6,000
„ Italy	13,000	12,000	− 1,000
„ Switzerland	18,000	10,000	− 8,000
„ Germany	17,000	29,000	+ 12,000
Internal combustion engines, stationary—			
Total	400,000	650,000	+ 250,000
From Great Britain	217,000	371,000	+ 154,000
„ France	4,000	4,000	—
„ Italy	12,000	7,000	− 5,000
„ Switzerland	96,000	135,000	+ 42,000
„ Germany	68,000	123,000	+ 55,000
Electric light bulbs—			
Total	39,000	45,000	+ 6,000
From Great Britain	700	1,600	+ 900
„ Germany	7,000	9,600	+ 2,600
„ France	1,000	2,000	+ 1,000
„ Italy	700	200	− 500
„ Holland	19,000	15,000	− 4,000
„ Czecho-Slovakia	100	1,300	+ 1,200
„ Austria	5,000	7,000	+ 2,000
Carbon rods for arc lamps—			
Total	700	500	− 200
Electric cars and wagons—			
Total	4,000	1,000	− 3,000
From United States	4,000	—	− 4,000
Telegraphic and telephonic apparatus and fittings—			
Total	49,000	121,000	+ 72,000
From Great Britain	36,000	92,000	+ 56,000
„ France	3,000	3,600	+ 600
„ Sweden	8,000	22,000	+ 14,000
Meters, electric, gas and water—			
Total	25,000	26,000	+ 1,000
From Great Britain	2,000	3,000	+ 1,000
„ France	16,000	16,000	—
„ Germany	5,000	3,000	− 2,000
Electric and gas pendants—			
Total	49,000	64,000	+ 15,000
From Great Britain	1,000	2,000	+ 1,000
„ France	20,000	28,000	+ 8,000
„ Germany	17,000	15,500	− 1,500
„ Italy	9,000	12,500	+ 3,500
*Electro-medical apparatus**	—	9,300	—
Other electrical appliances and batteries—			
Total	50,000	44,000	− 6,000
From Great Britain	14,000	9,000	− 5,000
„ Austria	1,000	600	− 400
„ France	6,000	6,800	+ 800
„ Germany	15,000	14,000	− 1,000
„ Italy	10,000	8,000	− 2,000
„ Switzerland	1,000	700	− 300
„ United States	2,000	3,000	+ 1,000
Electric cables, insulated—			
Total	96,000	40,000	− 56,000
From Great Britain	14,000	1,500	− 12,500
„ Belgium	9,000	5,000	− 4,000
„ France	36,000	8,000	− 28,000
„ Germany	15,000	12,000	− 3,000
„ Italy	14,000	7,000	− 7,000
„ United States	1,000	300	− 700
Electric wire and cable, armoured†—			
Total	—	69,000	—
From United Kingdom	—	3,000	—
„ Belgium	—	11,000	—
„ France	—	27,000	—
„ Germany	—	16,000	—
„ Italy	—	11,000	—
Uninsulated electric copper wire—			
Total	23,000	55,000	+ 32,000
From Great Britain	—	16,000	+ 16,000
„ France	14,000	25,000	+ 11,000
„ Germany	6,000	12,000	+ 6,000
„ United States	—	1,000	+ 1,000
Electric light fittings—			
Total	66,000	70,000	+ 4,000
From Great Britain	6,000	4,500	− 1,500
„ Belgium	2,000	2,000	—
„ France	14,000	14,000	—
„ Germany	28,000	34,000	+ 6,000
„ Italy	5,000	5,000	—
„ Switzerland	5,000	4,000	− 1,000
„ United States	2,000	3,000	+ 1,000

£E = £1 0s. 6½d.

* Previously included under "Other electrical appliances."
† Previously included under "Electric cables, insulated."

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A New Rectifier.

A rectifier has been put on the market by MESSRS. PHILIPS LAMPS, LTD., of 145, Charing Cross Road, London, W.C.2, for charging motor-car batteries of up to 6 V at 6 A, or up to 12 V at 3 A, from alternating-current circuits of various voltages up to 260 V. It consists of a transformer, a rectifying valve, and two current-regulating lamps, mounted on a base 8 × 6 in., in a neat case standing 14 in. high. The apparatus weighs 24½ lb. It is provided with a plug

Fig. 1.—The Philips Rectifier.

Fig. 2.—A New h.p. Cable-handling Pole.

for connection to the lighting circuit, and terminals for connection to the battery. When charging at 6 amperes, both waves are utilised, but for 3 amperes it operates as a single-wave rectifier; in the former case it takes about 150 W; in the latter case, at 10-14 V, 125 W, and at 2-8 V, about 90 W. On no-load it takes 20 W. The current remains constant, independently of the number of cells charged, and no ammeter is necessary; the charging terminals can be short-circuited without any ill effects, and the rectifier is silent in operation.

A similar rectifier, using both a.c. waves, is made to charge from 1 to 6 cells at a constant current of 1.3 A, and is very suitable for charging accumulators for radio sets; we have used one for some months for this purpose, and have found it in every way satisfactory. This set is contained in a neat perforated aluminium case.

The rectifiers work on all frequencies from 40 to 100 cycles, and on any voltage specified; the life of the valve and lamp is stated to average 1,000 hours. The appearance of the device is shown in the accompanying illustration (fig. 1).

An Electric Iron with Damping Device.

A new development in electrical apparatus for domestic ironing operations is represented by the introduction of the "Eldec" electric steaming iron, described in *Electrical Merchandising*, by the ELDEC Co., Inc., 501, Fifth Avenue, New York, which applies moisture to the material during the ironing operation. The "Eldec," a 6-lb. iron, fig. 3, is fitted with a water reservoir, contained in its insulated handle, with conduit leading to the bottom plate. The water, regulated by a

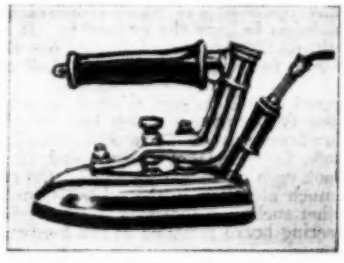

Fig. 3.—A Damping Electric Iron.

small turn-screw valve, passes drop by drop into the heated plate, and issues as steam through a series of tiny holes, forming a mist-like film on the fabric being ironed. The iron is designed for 106/115 V. It is nickel finished.

A New H.P. Cable-Handling Pole.

With the object of indicating the electrical state of the apparatus being dealt with, the Etablissements Merlin and Gerin, of Grenoble, France, have recently introduced an improved form of insulated cable-handling pole for the accompanying sectional drawing of which we are indebted to *L'Electricien*. The device (fig. 2) consists of a narrow tube C of bakelite, which, when protected from wet and damp, has a very high dielectric rigidity. As an additional protection against damp, the lower portion of the pole, from A to B, is filled with a melted insulating compound. The upper end of the pole terminates in a double hook used for the manœuvring of the cables, the hook being secured in position by a concentric device. The novel feature of the pole consists in mounting within it, between the hook and the plug A, a glass bulb which is visible through a slot in the pole. The bulb is filled with low-pressure neon, a gas which has the property of self-illumination when placed in an electrostatic field. The bulb is held in place by a felt packing and upper and lower springs R1 and R2. The two extremities of the bulb are connected through the springs with the double hook and with a metallic ferrule V.

When the hook is in contact with a live cable the electric field causes the neon to show a red light at voltages of 5,000 and over. The luminosity increases with the pressure and for voltages of 20,000 and over the bulb will show a light when brought near to but without touching the cable. It is claimed that by using a suitable length of bakelite tubing the pole can be safely employed for voltages up to 70,000. For the high pressures the neon tube is located at a lower point in the pole and is not connected with the hook.

In addition to manœuvring live cables into position the new pole can be utilised to test whether the two ends of an open sectioniser are of the same potential and phase. By placing the hook on one conductor and bringing the metallic ferrule into contact with the other, the luminosity in the neon bulb will disappear if the two conductors are of the same pressure and phase. The luminosity will, however, continue if only one of the conductors is live or if both are live but are not in phase. In using the pole for this purpose luminosity appears in the bulb at 2,000 V, due to the fact that not only is there an electric field, but a flow of current in the tube. In using the device for the testing of two conductors, the safe pressure limit so far as tests have been made is from 30,000 to 35,000 V.

Low-Speed Worm-Geared Motors.

MESSRS. MARRYAT & PLACE, 28, Hatton Garden, London, E.C.1, have recently added to their range of worm-geared

Fig. 4.—A New Fractional-h.p. Worm-geared-Motor.

motors, machines covering from ¼ to ¾ h.p., with shaft speeds of from 20 to 80 r.p.m. Fig 4 shows one of these machines. It is fitted with ball-thrust bearings, gun-metal bushed main bearings, gun-metal worm wheel and a castor-oil bath. The motors are continuously rated.

A Self-contained Outdoor Sub-station.

With a view to reducing the distribution costs in connection with the construction of brick and concrete transformer chambers and sub-stations, the FOSTER ENGINEERING CO., LTD., Morden Works, Wimbledon, London, S.W.19, has produced a self-contained outdoor sub-station, marketed in sizes up to 200-kVA capacity, and constructed for single-, two-, or three-phase, or for "Scott" connected three/two-phase transformation. The device is particularly suitable for use in connection with supplies to rural areas and isolated consumers. The transformer is housed in only one enclosure, thereby reducing heating losses. A specially designed chamber is fixed on top of the transformer containing the h.p. and l.p. control fuses, &c., including a tapping switch (connected to either the h.p. or l.p. side) and a substantially designed voltmeter and ammeter by which the load and pressure can be measured at any time. The standard control equipment also includes a plug connector, an isolating link and a tetrachloride on each phase, and an earthing link, mounted on a h.p. panel. A l.p. panel

is equipped with four fuses per phase, a bus bar for the return leads, and the necessary terminals for the incoming cables. The switch chamber has doors on opposite sides, one giving access to the h.p. panel and the other to the l.p. control gear. The combination of the transformer and switch chambers makes a pillar unit to which is added a cable column leading from the ground to the upper compartment. Fitted at the top of the column is a sealing chamber provided with armour clamps. Sockets are provided to accommodate the plug connectors on the h.p. side, and provision is made for the l.p. cable ends to be brought to the appropriate terminals. The transformer is of the oil-cooled type mounted in a strong steel tank of special construction, provided with rollers, which is fitted with cooling tubes for outputs of over 25 kVA. As it is desirable to keep the exposed fittings down to a minimum, the oil drain cock is arranged underneath the tank, and the oil gauge takes the form of a float with an indicating rod, the latter being inside the switch chamber.

In the case of a breakdown or other emergency it is intended that the whole sub-station be removed and another put in its place, making the operation much less formidable than removing a transformer out of a kiosk or chamber. The overall dimensions for a 3-phase, 100-kVA unit, are 72 in. high, 49 in. long and 32 in. wide.

Electrical Progress at Shanghai.

Annual Report of the Electricity Undertaking.

WE have received from Mr. T. H. U. Aldridge, M.I.E.E., engineer-in-chief and manager of the Shanghai electricity undertaking, a copy of the report of that concern for the year 1925. For the first time since its inception in 1901 the undertaking has suffered a drop in its output, the kWh sold during the year being 294,343,905, as compared with 307,307,401 for the previous year, a reduction of 4.22 per cent. This was due, of course, to the great strike. In spite of the diminished sales, the year's trading yielded a net profit of £212,953, against £219,624. In view of the reductions made in charges for lighting and heating during the year, 15.38 per cent. and 14.28 per cent. respectively, the result is particularly satisfactory. The estimated net profit for the present year, 1926, is £276,967. Of the profits for 1925 £180,000 has been contributed to the general municipal funds.

The plant capacity of the Riverside Power Station, including a 20,000-kW turbine then in the course of erection, was at December 31st last 121,000 kW The maximum peak load on the station during the year was 77,000 kW, and the maximum sustained load for thirty minutes was 76,600 kW, against 66,200 kW for 1924; the maximum load delivered to the feeders was 72,930 kW, an increase of 14.92 per cent. on the 1924 figure, as compared with 0.88 per cent. increase in that year on the 1923 figure. Since the close of the year under review the maximum sustained load has risen to 80,000 kW. The load factor for 1925 was 53.06 per cent.; this factor was calculated on the kWh generated to bring the result into line with the figures for the municipal undertakings in Great Britain. The number of consumers being supplied at the end of the year was 38,932, an increase of 2,413, representing 12,173 kW. The thermal efficiency of the station was increased from 16.2 per cent. to 17.43 per cent. The B.th.u.'s consumed per kWh generated have been reduced from 21,047 to 19,593.

The overall boiler efficiency was 77 per cent., but in the boiler house equipped with the larger boilers and operating under better conditions than the other two houses, the average efficiency was 79 per cent. Two of the larger boilers are being equipped with Howden-Ljungstrom air preheaters, which it is anticipated will increase their efficiency to 85 per cent.

The total length of underground cable in the distribution system at December 31st was 348 miles, of which 120 miles was 22,000-V cable. 4,265 miles of overhead cable was in existence. The total capacity of transformers in sub-stations, including induction regulators, was 266,278 kVA. The total c.p. of public lamps at the end of the year was 476,700, representing an increase of 25,000 c.p. A total of 116,650 h.p. of motors was connected to the mains, an increase of 6,857 h.p., during the year. The heating and cooking load added to the system during the year was 4,282 kW, bringing the total up to 13,450 kW. The rate covering these services was 1.08d. per kWh. The power rates varied from 1.08d. to 1.62d., and the lighting flat rate was 3.96d. per kWh. Special bulk supply rates are in some cases as low as 0.6d. per kWh, which is made up of an annual capital and fixed charge per kW demanded plus a running charge per kWh consumed, the latter being subject to adjustment each half year in accordance with the cost and calorific value of the fuel consumed.

In view of renewed business activity in Shanghai, the first instalment of a 50,000-kW extension is now in hand. This will consist of the 20,000-kW turbo-generator referred to and three boilers, each to evaporate 150,000 lb. of water per hour. A second turbo-generator and a fourth boiler of the same respective sizes are, it is hoped, to be ordered next year. Referring to the two new turbo-generators, Mr. Aldridge says that, as these machines will produce a considerable percentage of the total output, the economies of adopting higher steam pressures and superheat far outweigh any slight inconvenience which might be apparent by having two steam pressures in the same station. It is interesting to note that it is not expected to have to raise new money for the additional plant.

Notes from Canada.

(From Our Special Correspondent.)

FOLLOWING the death of Sir Adam Beck there was not for some time much to record regarding the doings of the Hydro-Electric Power Commission of Ontario. No doubt there would have been somewhat of a lull in any case until the new chairman had had time to take in the situation and get his bearings, but it seems as though the past few months must have been filled with work behind the scenes which has just begun to bear fruit. Owing to the rapid rate of growth of the loads on the Commission's systems, the one urgent need was to find sources of power additional to those at present available. There were several possibilities:—(*a*) Additional diversion of water from the Niagara river; (*b*) Development of power on the Ottawa River; (*c*) Development of power on the St. Lawrence River; and (*d*) The building of one or more large steam generating stations at suitable points.

With regard to (*a*) Canada desires to have a full settlement of the Chicago diversion question before any change is made in the International Boundary Waters Treaty which specifies how much water may be diverted from the Niagara river by Canada and the United States, the figures being 36,000 and 20,000 cubic feet per second respectively. Chicago, in the language of her opponents, is "stealing" something like 10,000 cubic feet per second from the Great Lakes system by taking water from Lake Michigan through the Chicago Drainage Canal and running it into the Mississippi River. The ostensible reason is for sewage purposes, but incidentally a considerable amount of power is generated from this water from which, it is said, the Chicago authorities derive a by no means insignificant profit. Development of power on the Ottawa River (item *b*) seems likely to be undertaken by the Commission in the near future, but it would not be available for use in time to prevent a power shortage. The same objection applies with greater force to item (*c*) on account of the international problems which have to be solved, the magnitude of the undertaking, and the fact that the question of navigation is more or less bound up with that of the generation of power. Item (*d*) seems to have received a good deal of attention, particularly in Toronto, where the simultaneous supply of electrical energy and heat, combined with the possibility of establishing a coking plant which would supply coke for domestic heating and, presumably, oil and gas for power generation, has been under discussion. In the United States the supply of heat (using exhaust steam) as well as electricity is undertaken in a number of instances and seems to be making headway steadily if somewhat slowly.

The Commission is meeting the more immediate needs of the power situation by arranging to purchase power from Quebec Province. The Ontario Government has recently authorised the Commission to make a contract for the supply of from 230,000 to 260,000 h.p. with the Gatineau Power Co. The company will develop the power on the Gatineau River at a point near Ottawa and close to the boundary between Ontario and Quebec. Delivery of 80,000 h.p. is to be made in 1928 and the full amount by 1931. The contract is for 30 years, commencing with 1928, and the price of power at the point of generation will be $15 per h.p.-year. The Commission will build a 230-mile, 230,000-V transmission line to take the power to Toronto, where the total cost of the delivered power will be about $22 per h.p.-year. The capacity of the transmission line will be from 300,000 to 400,000 h.p., so that the needs of Eastern Ontario can be served, as later on power from other sources will be fed into the same transmission line.

Shortly after making an official statement regarding the power contract mentioned above, the Hon. Howard Ferguson, Premier of Ontario, made a most important and gratifying announcement to the effect that the Provincial Governments of Ontario and Quebec will in the very near future appoint a joint engineering board to survey and report on the power possibilities of the Ottawa River, the question of the remission of Quebec's export tax on power (50 cents per h.p.) in the case of the contract to be made between the Gatineau Power Co. and the Hydro-Electric Power Commission of Ontario, and the agreement between the two Provincial Governments to jointly resist any action by the Dominion Government to lease or sell any power sites of which either of the Provincial Governments claims to have the ownership. It is understood that the Provincial Government of Quebec has already agreed that the power to be exported to Ontario shall be free of the tax.

The full accord on all matters relating to power questions as affecting the two provinces which has thus been reached is of great significance as, owing to differences in race and in religious beliefs, the people of Quebec and Ontario have a tendency to look each on their own side of the shield without paying over much attention to the other. Consequently, any drawing together such as is indicated by the decision to create a joint engineering board is hailed as the forerunner of better relations all round.

Referring to the Gatineau River, a recent issue of the *Canadian Engineer* states that "acquisition of the Hull Electric Co. by the International Paper Co. will give the latter company practically full control of the Gatineau River as far north as the great water storage dams which are being built at Maniwaki." The International Paper Co. controls the Gatineau Power Co., which will supply power to Ontario as stated above.

The Institution of Electrical Engineers.

The Council's Annual Report and Accounts for 1925-26.

AT the annual general meeting on May 27th the Council's report and accounts for the year April 1st, 1925, to March 31st, 1926, which are summarised below, were presented, indicating a net increase in membership of 399, which raised the total to 12,142; there were 67 deaths, 140 resignations, and 381 lapses of membership during the period under review; there are 11 honorary members. The A.M.I.E.E. examination was held at eight places in this country, and also in Australia, Ceylon, India, New Zealand, South Africa, and the U.S.A.

During the past 12 months 374 meetings were held in London and at the local Centres by the members, the Council, and the various committees. The interest in, and attendance at, the meetings of the local Centres and Sub-Centres have been well maintained, whilst the Wireless Section held eight meetings at which nine papers were read and discussed. In view of the suggested formation of a separate wireless society the Committee of the Section reported to the Council with a view to developing and extending the activities of the Section.

Eleven informal meetings have been held during the session, the average attendance being 65, as against 59 last year. There are at present 3,582 students on the register of the Institution, and meetings, visits to works, and social functions have been carried out at the eight Students' Sections now in existence. The London Students' Section created an interesting precedent last summer by holding a summer meeting in London, and in addition to London students it was attended by some 20 students from the provinces and Scotland.

The Faraday lectures this session were given by Mr. A. P. Trotter, who took for his subject "Illumination and Light," and were delivered at Cardiff, Dublin, Liverpool, and Manchester. The attendances were very satisfactory, and the principal object of the lectures, namely, to direct the attention of the general public to electrical engineering, was achieved to a marked degree by the presence of many hundreds of non-members.

The Council decided this session to publish in the *Journal* periodical reviews of progress in electrical engineering, and for this purpose the subject has been divided into 13 sections, a beginning having been made this year with six sections, and a further selection will appear in 1927. The reviews briefly record recent advances and are intended, not so much for the information of experts in the particular subject under review, as for the information of those members of the Institution who wish to follow the trend of progress in branches of electrical engineering other than their own.

A David Hughes and two Salomons scholarships were awarded by the Council, in addition to a grant of £100 for educational purposes from the War Thanksgiving Education and Research Fund (No. 1).

The annual conversazione was attended by 1,400 members and guests; the annual dinner was particularly well attended, members and guests numbering 575, and 350 members and ladies took part in the summer meeting.

At the third session, in June, 1925, of the Paris International Conference on Large E.H.P. Supply Systems the number of countries represented was 27, Great Britain being represented by seven delegates appointed by the Institution and 21 ordinary members; the number of papers presented was 98. At the New York meeting of the International Electrotechnical Commission, in April, 1926, 16 countries were represented, and there were 24 British delegates, including four appointed by the Council to represent the Institution. The Council, which took an important part in founding the Society of Radiographers in the year 1920 and (under that Society's constitution) had until last year nominated six out of the 18 members of the Society's Council, has withdrawn its nominees and terminated the Institution's connection with the Society because the majority of the Council of the Society of Radiographers resolved upon alterations to the Society's articles, which in the opinion of the Council of the Institution were not in the public interest.

The September, 1921, edition of the Model Conditions "A" (Home—with Erection) has been amended to make it clear that the regulations and by-laws with which the contractor has to conform are those which the local or other authorities are authorised by statute to make; the new edition (revised January, 1926) in all other respects conforms with the old edition. The following sets of conditions were also issued during the session:—B1. Conditions for Export Contracts (delivery f.o.b.); and B2. Conditions for Export Contracts (including complete erection, or supervision of erection).

The former five "Sectional Committees" have been reorganised as nine "Technical Committees," whose functions will be to obtain suitable papers on subjects within their respective fields and to assist the Papers Committee in connection with the reviews of progress referred to above. With the concurrence of the Council of the Institution and of the National Gas Council, a joint committee has been set up "to consider whether in the national interest an inquiry might advantageously be held into the possibility of closer co-operation between gas and electricity undertakings in promoting capital and fuel economy in the supply to the public of energy derived from coal."

During the year 163 books and pamphlets have been presented to the Reference Library, and 80 volumes have been purchased. The total number of readers for the year was 3,537, of whom 114 were non-members, as against 2,419 and 108, respectively, in 1924-25. The Council records the continued circulation of books from the lending library, to which 71 new volumes have been added; during the year, 1,938 books were issued to 857 borrowers, the corresponding numbers for the previous year being 2,184 and 872, respectively.

The number of applicants for posts who were registered by the Electrical Appointments Board on March 31st, 1926, was 87, against a total of 78 last year. The Council earnestly hopes that members in a position to assist will not fail to make use of the register.

The net cost of printing and posting the *Journal* in 1925, after allowing for sales and the revenue received from advertisements, was £4,166, as compared with £3,078 in 1924. This increase was due to the greater size of the volume (1,180 pages, as compared with 1,006 in the previous volume), the larger number of copies printed (12,500, as against 12,000), and an appreciable increase in the number of illustrations. The revenue from sales and advertisements was practically the same in the two years. The physics volume of *Science Abstracts* for 1925 contained 195 pages less than for 1924, and the electrical engineering volume contained 39 pages more than in the previous year; the net cost of the publication to the Institution in 1925 was £281.

The report of the Committee on Electricity in Agriculture has been published, and the Council has instructed the Committee (1) to prepare a special recommendation to the Government in connection with the provision of financial assistance for rural electrification, and (2) to co-operate with agricultural bodies in tests and experimental work. The Council has also addressed a letter to the Electricity Commissioners urging that, in any schemes of railway electrification, regard should be had to the requirements of rural areas.

Regarding the award of national certificates and diplomas in electrical engineering, for the final examinations of 1925 the Joint Standing Committee representing the Board of Education and the Institution examined at various schools and colleges students from 46 approved courses for the award of ordinary certificates in electrical engineering, 17 courses for higher certificates, 3 courses for ordinary diplomas, and 1 course for higher diplomas. The final examinations were held during the summer of 1925, and the number of awards was as follows:—229 ordinary and 79 higher certificates; 8 ordinary and 2 higher diplomas.

The Council has authorised the publication of a revised edition (the second) of the I.E.E. Regulations for the Electrical Equipment of Ships, and as a result of suggestions in connection with the revised edition of the Regulations for the Electrical Equipment of Buildings, the Wiring Rules Committee recommended the Council last summer to publish a small number of amendments which were considered to be of sufficient importance to justify their immediate publication. Further alterations have been, and some still are, under consideration by the Committee and, if not published separately, will be incorporated in the next revision of the Regulations. The Committee is also conferring with the B.E.A.M.A. and the B.E.S.A. in connection with certain of the Regulations.

The Council has approved for submission to the Electricity Commissioners a report from the Electricity (Supply) Regulations Committee containing recommendations on the Electricity Commissioners' Regulations (*a*) for securing the safety of the public, and (*b*) for ensuring a proper and sufficient supply of electrical energy. During the session the Council approved a report of the Proving House Committee, "having in view that there appears to be very little interest in the establishment of a testing authority and proving house," that the proposal be dropped.

In December, 1925, the Council received an invitation to join a delegation which the First Lord of the Admiralty had consented to receive on the status of engineer officers of the Royal Navy, which, it was considered, was detrimentally affected by the new conditions introduced by Fleet Order No. 3,241, of November 21st, 1925. Representatives duly met in conference delegates of the Institutions of Civil and Mechanical Engineers and of Naval Architects, and the deputation was received at the Admiralty on January 14th, 1926. A reply has since been received which is considered by the joint Conference as unsatisfactory, and steps are being taken to carry the matter a stage further.

The Committee of Management of the Benevolent Fund of the Institution reports that on December 31st, 1925, the capital account of the fund stood at £10,004 and the accumulated income at £2,380. The donations and subscriptions to the fund in 1925 amounted to £1,241. In 1925, 78 grants were made to 30 persons, amounting to a total of £1,199.

The Institution's annual accounts show that, after making provision for contingencies, there is a margin to the good on the revenue account for 1925 of £1,196, which has been carried to the credit of the general fund, and compares with £2,925 in 1924. The assets amount to £145,336.

The Annual General Meeting.

The usual small attendance was presided over by Mr. R. A. CHATTOCK, who drew attention to the chief items in the Council's report for the year, intimating at the same time that the summer meeting at Newcastle would be held there next year, it having been cancelled this year on account of the coal miners' strike.

Mr. E. W. MOSS seconded the adoption of the report and accounts, and asked about the Registration of Engineers' Bill.

Mr. F. W. PHILLIPS asked about the possibility of arranging for the publications of engineering institutions to be obtainable abroad at reduced rates, and suggested that it would be more in keeping with the dignity of the award if the Faraday medal were made of gold or platinum. He then spoke of grievances which are said to exist on the part of some students who are transferred to the Graduate class, and urged the Council to make the Graduate class more attractive so that it would be regarded as a real step in the upward direction of membership. After commenting on the Council's action in issuing a circular in December in connection with members enrolling as volunteers in case of a national emergency, Mr. Phillips suggested that the time had come to reinstate "enemy" members.

Mr. F. W. PURSE said that although there was a total increase of 399 in the membership last year, it represented principally Students and Graduates, the fact being that in two years there had only been an increase of 17 corporate members; that could not be regarded as satisfactory for the premier engineering institution in this country. The Institution did not seem to be making the progress it should, for no fewer than 228 Students had lapsed last year and 77 had resigned. The average expense per member was about £2 10s., and the subscriptions of the Students did not cover that; the Council should review the position as regarded Students' subscriptions and also the relationship between full and associate membership, his point being that many Associate Members ought to be full Members, but they did not transfer because they got all the privileges for a lower subscription.

Mr. A. H. ALLEN commented on the fact that no reference was made in the report to the protest made by the Institution some time ago in connection with the Electricity Supply Bill, 1926, and expressed the hope that the matter would not be left there.

The PRESIDENT said it was not intended to take further action in connection with the Electricity Supply Bill, it being thought that the various sections of the Institution could better voice their own particular points of view with regard to the Bill; no decision had been come to with regard to the Registration of Engineers' Bill, and any necessary action would be taken when the occasion arose. The Faraday medal, after all, was given as an honour (not for its material value), and the Council felt that it should remain a bronze medal. He did not agree with the comments of Mr. Phillips as to the Graduate class, and he regarded it as a very useful class for those Students who could not, for the time being, take the associate membership examination. As to the strike, the Institution merely sent out the circular at the request of the Government without expressing an opinion, as the Council did not consider it within its province to take part in industrial matters. The fact that there had been only a small number of new corporate members during the past two years was due to the stiffening-up of the requirements for membership, and there need be no fear that the Institution was going back; it was essential to maintain the supply of Students, who, however, had not much money, so that they should "temper the wind to the shorn lamb" by fixing a small subscription for Students. The question of "enemy" members would be dealt with when the articles of association were next revised.

The accounts were adopted after the hon. treasurer had explained that the increase in expenditure of nearly £5,000 was accounted for by certain special items, such as the rewiring of the Institution building, which would not recur as an annual charge.

Electric Incubation.—It is known that eggs hatching under a hen vary in temperature by several degrees at the top and bottom. Although it is not known why this is desirable, experimenters in this country, according to *Science*, have tried to imitate the condition by covering artificially hatched eggs with a thin sheet of rubber to keep the top warmer; they claim a highly increased percentage in their hatch. Mr. Edmund Burke, Chemist at the Agricultural Experiment Station at the University of Montana, has, as the result of recent experiments, concluded that the electric incubator is the most satisfactory substitute for the hen. The temperature can be more readily controlled to simulate the required conditions than with the older types of hot-air incubators. Mr. Burke found in his experiments that the carbon dioxide and moisture given off by the body of the hen during hatching are necessary elements in the chemical changes that render the calcium of the shell available for the bone formation of the embryo chick. Electric incubators were found to be superior in reproducing this condition also. The amount of moisture and carbon dioxide could be more easily controlled than in the hot-air types, and the quantity of each admitted to the eggs approximated more nearly to the amount given off by the hen with a consequent increase in the hatching percentage of viable chicks.

Electroplaters' and Depositors' Technical Society.

Heavy and Rapid Copper Deposition.

A DISCUSSION on this subject was held at the Northampton Polytechnic Institute on April 14th. The opener, Mr. J. S. SUNDERLAND, dealt principally with the deposition of printers' electrotypes, but subsequent speakers, Mr. F. S. SPIERS (since deceased), Mr. A. E. OLLARD, and Mr. D. J. MACNAUGHTON among others, spoke on the process of manufacture of heavy copper cylinders, such as are used by calico printers, copper engraved printing plates, the reproduction of chased or modelled decorative panels, and other processes where deposits of considerable thickness are required.

It is well-known that the rate at which the electrodeposition of copper can be maintained and the quality of the deposit, both as regards mechanical properties and smoothness, are determined by the following factors:—(1) Composition of the solution; (2) its temperature; (3) the rate of agitation of the solution; (4) the presence of so-called "addition agents." As regards (1) all experience shows that a solution consisting of about 14-18 per cent. crystalline copper sulphate and 4-6 per cent. free sulphuric acid is the most satisfactory for most purposes and within that range any composition will yield satisfactory metal if the other factors are suitably adjusted. It appears that a solution approximating to 15 per cent. sulphate and 5 per cent. acid happens to be the optimum composition for maximum current efficiency at the cathode combined with minimum corrosion of the electrodes by chemical action. Too high a concentration of copper in solution tends to yield soft deposits—that is, of large crystalline structure—unless the acidity also be high, and then the solubility of the sulphate is diminished, so that on cooling the solution the salt may crystallise out on the electrodes, rendering them non-conducting.

The advantages of working at high current densities are increase of output, and thus a diminution of capital charges, and a good mechanical quality of deposited metal. For such purposes as printing plates the latter requirement is essential, and it is also necessary that the deposits should be extremely smooth. Both conditions can be satisfied if the solution be adequately agitated, and one speaker advocated the procedure of driving the solution between anode and cathode by means of suitable pumps, as being a far better method than the employment of blowers, agitators, or fans. Of course, in certain uses, such as the manufacture of copper tubes, the cathode itself can be revolved at a high speed on a mandrel, as in the Cowper-Coles process. In either case, there is a beneficial quasi-burnishing effect of the solution on the cathode which tends to harden the deposit, as well as the rapid renewal of electrolyte close to the deposit required when a high current density is employed. The "treeing" which occurs along the edges of a deposit when a high current density is used can be reduced, if not eliminated, by keeping the solution perfectly clear and free of suspended matter. In some processes the solution is being constantly filtered while circulated, and it may sometimes be advantageous to enclose the anodes in bags to prevent the anode-sludge from contaminating the solution.

Changes in the constitution of the solution were referred to in the course of discussion. It was pointed out that current at the cathode converted cupric into cuprous ions, and that but for the free acid present cuprous oxide would be deposited. The presence of cuprous copper might be the cause of a change in the colour of solution from blue to green often observed. From such solutions copper inferior in mechanical qualities would be deposited and one remedy was to oxidise it by means of aeration. This reaction, as well as ordinary chemical corrosion, would usually cause more copper to dissolve than was deposited, an effect accelerated by high current density and rapidity of agitation, so that solutions usually needed periodical readjustment due to enrichment by copper.

Where copper of high tensile strength or hardness was required it was desirable to apply mechanical tests, a procedure not sufficiently practised in this country. The use of Brinell hardness tests, in particular, was recommended. The curious phenomenon was referred to of the influence of the cathode material on the crystalline structure, and hence mechanical properties, of the deposit. Copper deposited on plaster was large-grained and therefore inferior in quality to that deposited on wax, for example; and even the treatment of the surface, such as graphiting and silvering, had an effect on the grain. The reason for this was pointed out many years ago by the late Professor A. K. Huntington, who proved experimentally that the first layers of an electrodeposited metal tended to conform to the crystalline structure of the base metal. It was stated that to obtain copper of the highest ductility and tensile strength it was necessary to have recourse to one or other of the colloidal organic substances added in minute qualities to electrolytic solutions. Experience could indicate to a nicety how much to add from time to time, the quantity depending mainly upon the acidity of the solution and the amount of work it was called upon to perform.

The discussion generally must have been of considerable value to those engaged in the practical art of copper deposition and was a tribute to the utility of the newly-formed Society.

The Electric Drive of Reciprocating Machine Tools.

The Ward-Leonard v. The Single-Motor System.

By L. MILLER, A.M.I.E.E.

(Abstract of a paper read before the MANCHESTER ASSOCIATION OF ENGINEERS.)

THE paper discusses investigations carried out by the author, assisted by certain members of the staff of the Metropolitan-Vickers Electrical Co., into the question of developing a satisfactory drive for the table of a planing machine. At the time the investigations were started the most successful drive was the Ward-Leonard. The single-motor drive utilising d.c. from the power mains was a very bad second. Its lack of success appeared to be due to trouble with the control gear, but the application of contactor gear solved the difficulties, with one exception, *viz.*, the prevention of the table of the planing machine coming off the slides in the event of failure of voltage. This difficulty was eventually overcome by utilising a series winding on the motor to provide excitation on the failure of the power. This winding was connected so as to obtain dynamic braking at the instant of reversal, but not in the current-carrying circuit, except when stopping and starting in the reverse direction at the end of the stroke, or on failure of power.

From oscillograph curves taken from planers equipped with the single-motor drive and also the Ward-Leonard drive, it is clear that the acceleration curve for the planer table is such that on short-stroke work the planer table cannot achieve full speed before a reversal takes place. This is true of either the Ward-Leonard drive or the single-motor drive. The actual effect of this on the time occupied in completing two reversals, a cutting stroke at 42.4 ft. per minute and return strokes varying from 51.4 ft. per minute to 150 ft. per minute (or a complete

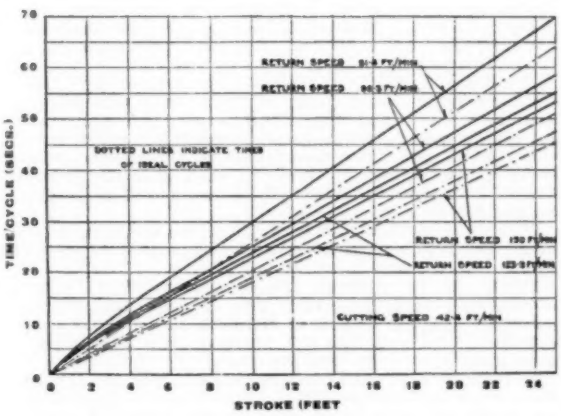

Fig. 1.

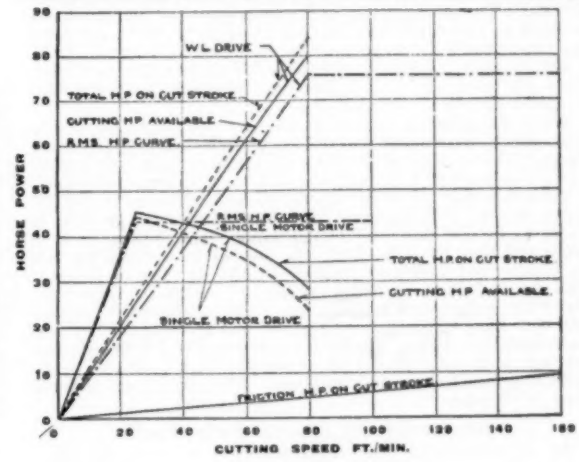

Fig. 2.

cycle) for different lengths of stroke, is shown in fig. 1. The straight lines on the curve indicate the ideal time of one cycle, that is, the time occupied on the assumption that the planer takes no time to reverse, and immediately reaches speed on either stroke. These results were taken for a very heavy planer of an old type, that had been converted to electric drive. These curves make clear the fact that the saving in time between a return speed of, say, 100 ft. per minute and one of 150 ft. per minute amounts to not more than 8 per cent. on the large planer. They also show that the loss of time due to reversing and accelerating is very small indeed, and nothing like as much as would be at first anticipated. At 1/5 of the maximum stroke on the large planer, it amounts to 2.93 per cent. and on the maximum stroke 2.28 per cent., an average of about 2.6 per cent. The power required to return the table at 150 ft. per min. is 50 per cent. greater than that required to return it at 100 ft. per min. An objection to returning the table at a high speed is that it is often very difficult to secure the work to the table in such a way as to ensure that it will not move when accelerating and retarding on the high-speed stroke.

In order to get a high-speed return, say, of 150 to 180 ft. per minute, with a minimum cutting speed of, say, 25 ft. per minute, by shunt field control, it would be necessary to utilise a Ward-Leonard equipment, since the single-motor drive would only give about 100 ft. per minute with a minimum of 25 ft. per minute by shunt field control. The extra cost of the Ward-Leonard equipment, compared with a single-motor equipment, is approximately 70 per cent., and it is very difficult to justify such a capital outlay. This difficulty is further increased when it is realised that, if heavy cuts at low speeds can be taken, the single-motor equipment is capable of removing considerably more metal in a given time than the Ward-Leonard equipment in spite of the high-speed return.

The single-motor drive can only give a maximum difference of speed between the lowest cutting speed and the highest return speed of one to four without dissipating some energy in resistances. This is due to the fact that it is not regarded as commercially feasible to build a motor having a greater speed range than one to four. It is possible, however, to get a wider range by a double-voltage system, or by means of resistances connected in the armature circuit. It is also possible by suitably arranging the resistance to obtain very little speed variation with load, and some very successful drives are operating with this form of control embodied. On the other hand, the Ward-Leonard drive, since it is a self-contained power unit, will give almost any reasonable speed range up to a maximum of one to ten. This speed range is obtained by varying the voltage of the generator up to about half of the maximum speed, and varying the field of the motor driving the planer to obtain the other portion of the speed range.

The Ward-Leonard equipment has its motor running at the top speed for a much higher table speed than the single-motor drive. As a consequence of this the motor of the single-motor drive runs at a much higher speed than that of the Ward-Leonard drive on the cutting stroke for the same cutting speed. Therefore, the single-motor drive has to deal with considerably more stored energy on the cutting stroke than the Ward-Leonard equipment. The effect of this, in reducing the available h.p. for cutting metal, is clearly indicated in fig. 2. This means, of course, that in actual fact it would be possible to push up the speed of the Ward-Leonard motor and to make a reduction in the price by doing so without seriously affecting its cutting characteristic at normal cutting speeds. The exact difference in the cost between the two drives depends upon the design of the Ward-Leonard set.

The h.p.-speed characteristics of the Ward-Leonard and single-motor drive are shown on fig. 2. Characteristic curves have been drawn for the r.m.s. h.p. and for the actual h.p. available for cutting in both cases. The root-mean-square characteristic indicates that constant h.p. is obtained with the Ward-Leonard drive from 80 to 160 feet per minute, and constant torque from 80 feet per minute downwards. The curve, showing the power available for cutting also indicates the same characteristics except that, of course, reductions have to be made for the friction load at the high speeds and the stored energy at reversal. The effect of these factors is clearly indicated on the curve. The r.m.s. curve for the single-motor drive indicates constant h.p. from 25 to 100 ft. per minute, and constant torque by control of the voltage by means of resistance in the armature circuit from 25 feet per minute downwards. The power available for cutting is also clearly indicated on this curve, and the effect of the stored energy and friction load is clearly indicated for the various speeds. It will be seen that the effect of the stored energy is nothing like so great in the case of the Ward-Leonard equipment as it is in the case of the single-motor drive. In spite of this, however, it is clear from the curves of the Ward-Leonard equipment that it is not possible to take a bigger cut at 25 feet per minute than it is at 80 feet per minute, whereas with the single-motor drive it is possible to take a cut at 25 feet per minute of practically six times the area at 80 feet per minute. This characteristic conforms more nearly to that required for removing metal than the Ward-Leonard characteristic, and also a great deal more metal is removed at low speeds when heavy cuts can be employed.

The power available at the low speeds, in the case of the single-motor drive, enables it in practically all the cases investigated to remove more metal in a given time than the

Ward-Leonard equipment, in spite of the very considerably higher speed return. It is also seen that the high power, which can be obtained at high speeds with the Ward-Leonard curve, cannot be used because it usually falls outside the limit of cutting speed. The characteristic, with the 1 : 2 speed range on the motor, is very bad in this respect, and fails to give adequate power at the low speeds, and in fact is really not suitable for removing metal. The characteristic with the 1 : 4 speed variation is better, and conforms more nearly with that of the single motor drive. It is apparent, however, that the results obtained with the Ward-Leonard equipment cannot justify any increased cost, except in such cases where it is impossible to remove heavy cuts. In order to get any advantage from the Ward-Leonard drive sufficient to warrant the extra cost, it would be necessary to increase the distance between the two limit curves. This can only be done by decreasing the time per cycle, which is practically impossible.

Notes from South Africa.

(From Our Special Correspondent.)

Durban Bulk Supply.

AN agreement has been prepared between the Electricity Supply Commission of South Africa and the Durban Town Council embodying certain amendments which have now become necessary consequent on the decision of the Commission to purchase two 6,000-kW turbine sets and two 60,000-lb. boiler equipments from the Durban Town Council when the Council's present station shuts down on its taking supply from the Commission. It may be remembered that the original agreement was entered into in March, 1925, and provided for a supply of 9,000 kW and 48,000,000 units per annum, the charges being:—A fixed charge at the rate of £33,500 per annum, or £3 14s. per kW, and a minimum of 48,000,000 units at 0.29d. The amendments to the agreement are that the basis be fixed at 14,000 kW at a standing charge of £5 8s. per kW, and 60,000,000 units at 0.2d. per unit, which will operate from about January, 1929, by which date it is hoped that the Commission's plant will be installed and in working order at the Congella (Durban) power station.

While the existing agreement shows a load factor of 61 per cent., the new proposal will not be so high, being 49 per cent. Though at first sight it may not appear to be so advantageous to the Durban Town Council, the new scale will certainly show a distinct saving when its consumption exceeds the 60,000,000 units, which, judging from the present rate of growth, is likely to be the case well before supply is available, as it is estimated that by July, 1928, the Durban power station will be turning out well over 70,000,000 units, in view of the present demands that its cheap supply of current has brought about for cooking and heating, &c. The Commission station will thus have installed two 6,000-kW and three 12,000-kW sets and eight large boilers fitted with pulverised fuel firing apparatus, and it is anticipated that an early start will now be made with the foundations and buildings. The agreement is for a term of 30 years.

Pietermaritzburg (Natal) Bulk Supply.

An agreement has also been prepared between the Electricity Supply Commission of South Africa and the Pietermaritzburg Town Council in regard to supply of electricity in bulk to that city from the Commission's power station at Colenso. The agreement will date from August 1st, 1927, to July 31st, 1932, and the charges are as follows:—

(1) A fixed charge of £150 per annum, plus £5 per kVA of maximum demand.
(2) A charge of 0.3d. per unit for the first million units.
0.2d. per unit for the next two million units.
0.15d. per unit for all over.

The change-over to the Commission supply will mean drastic alterations in the distribution system, as the supply at present is single phase, 100 cycles, whereas the Commission's supply is three-phase, 50 cycles.

Durban Time Clock.

Durban has for many years made use of its electricity supply for indicating the time by the dimming of the lights at 8 p.m. by the insertion momentarily of extra resistances in the field exciter circuits of the generators at the power station, but it is now proposed to go one better and have the time controlled throughout the whole 24 hours by those who wish to install such clocks, which will be of the synchronised type. The master clock has already arrived, and will shortly be put into operation, so that Durban will be the first town in South Africa to introduce this service, and perhaps it may be ahead of many a Home town in having municipal synchronisation of time.

Trade Mark for C.M.A. Cables.—It is announced that as the result of certain cable manufacturers at home and abroad who are not members of the Cable Makers' Association applying to their own products the term "non-association grade," the trade mark Nonazo has been registered in the name of the C.M.A. This name is to appear on the labels of "Non-Association" class cables made by members of the Association.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Earth Tubes in Radio Sets.

Radio users should be indebted to Mr. Paul D. Tyers for his article in your issue of May 7th. With reference to water-pipe earths, he remarks that "the efficiency depends upon the actual conditions of each specific example"; I think this is even more applicable to driven earth tubes, as those which give poor results are as a rule not properly designed for use in the ground which is usually found near a house, but may be satisfactory in a moist flower bed. For this reason, I prefer an iron tube with a welded spike, which can be driven, if necessary, through a gravel path; by filling the tube with carbon, kept moist in dry weather, I utilise the internal surface of the tube, the carbon surrounding the earth wire. I received the following account of a two years' test from the technical expert of a well-known company: "Your tubular earth was driven through brick rubbish and stones just below the window, where the set is installed, and there is not the slightest difference between this and the water main earth."

If Mr. Tyers will make a test, I am sure the G.E.C., who supply the device, will be very pleased to give every facility.

Killingworth Hedges.

London, *May 25th*, 1926.

The Independent Power Plant.

One of the first steps taken by the Government to deal with the situation created by the General Strike was to restrict the use of electric power. As a direct consequence, many works were compelled to work short time, although they were really in a position to carry on normally. The resulting loss to the firms concerned, and the hardship to their employés, were, unfortunately, unavoidable, and everyone must agree that the Government acted wisely in imposing the restrictions.

The very fact that these restrictions were necessary does, however, make one wonder whether the Government will still proceed confidently with its electricity scheme.

The General Strike has forcibly demonstrated the value of the independent power plant. Manufacturers who generated their own power, and were, consequently, not dependent on the electric power stations, found themselves in a very favourable position, and it is certain that many of those who suffered under the restrictions will profit by the lessons the strike has taught them, and will install their own power plant at the earliest opportunity.

Cheap and plentiful power is one of the country's greatest needs, but it is a great mistake to assume that super power stations are the only means of providing it.

Power can be produced now in private plants quite as cheaply as (and in some cases even cheaper than) the super power stations will be able to distribute it. (It is, of course, the distributed cost that the consumer will pay, which is quite a different thing from the cost of production.)

In common with most other makers of power plant, we can show the manufacturers of this country how to produce electric power and light for use in their own works, at from ¼d. to 1d. per unit (everything included), at the same time rendering them quite independent of power station strikes or lockouts.

For **Blackstone & Co., Ltd.**
G. M. BLACKSTONE, *Managing Director.*

Stamford, *May 26th*, 1926.

Country-House Fires.

Having followed the correspondence in connection with the above, I should like an opportunity of replying to "Engineer Surveyor." Speaking generally, I have not found any great difficulty in obtaining tests provided the client is approached in the right manner. What is often refused when insisted on is generally obtained when asked for. I also think "Engineer Surveyor's" remarks *re* the non-tariff companies are in the way of a cheap advertisement. I can assure him that as far as my own company is concerned I have yet to find it accept any risk that I, as its electrical surveyor, turn down. What I consider to be even more important than an occasional test is an inspection during the time that the installation is being put in.

Electrical Surveyor
(NON-TARIFF).

May 31st, 1926.

Electricity Meters.

Both your leaderette and your correspondent emphasise the fact that meters may go either slow or fast owing to the instability of the permanent magnet.

The Bastian Meter Co., Ltd., have for many years been working to produce a meter *without* this so-called permanent magnet, and I am happy to inform you that their efforts have now been crowned with success.

After a great deal of research work a method of overcoming this difficulty was invented and a meter on this invention has been designed, tested, and patented. Work is in progress now to place this meter on the market on a commercial scale.

F. J. Campbell Allen,
Managing Director BASTIAN METER CO., LTD.
London, *May 31st*, 1926.

Legal.

McCarthy v. Leicestershire and Warwickshire Electric Power Co.

AT the Ashby County Court on May 20th, Michael McCarthy, New Swannington, sued the defendant company for damages and an injunction in respect of poles erected by the company on his land at Coalville. Mr. F. W. WALLACE, for the defendants, stated that the land was in no sense building land, and it was not possible that the value of the land had been seriously reduced by the erection of the poles, as was alleged by the plaintiff. Colonel GERMAN, a witness for the defendants, said the land was quite unsuitable for the erection of dwelling houses. It was almost tucked under a railway embankment, where the coal from seven collieries was collected, and shunting went on day and night. After a long hearing Judge T. E. HAYDON said that the railway traffic at the spot made it an impossible site for houses, but he was not satisfied that the land could not be made use of as a site for factories. He estimated the value of the land at 10d. per square yard; and in his view the erection of the poles halved the value of the land. He was therefore in favour of plaintiff for as many fivepences as there were square yards in the plot affected. The exact amount having been ascertained his Honour gave formal judgment for plaintiff for £3 10s. 10d., plus the amount paid into Court, in all £15 18s. 4d. Costs were awarded on Scale B and the injunction was refused.

An Electric Stove Exonerated.

BEFORE Judge Cluer, in the Whitechapel County Court, on May 21st, Esther Libstein, Clapton, E., sued Mr. S. Skropski, Whitechapel Road, E., to recover £7 7s., damage done to a coat through the alleged negligence of the defendant. Mr. White appeared as counsel for the plaintiff and Mr. Walter Stewart, barrister, for the defence.

In opening the case, Mr. WHITE said the suit was a novel and peculiar one. The plaintiff went into the defendant's shop to make a purchase, and at the time there were three other customers there. The shop not being a large one, she went into a corner of it and had not been there long before she noticed a smell of burning and discovered her coat was alight. This had been caused by its coming into contact with an electric stove, and irreparable damage was done. He (Counsel) submitted that it was negligent for a shopkeeper to have an electric stove in his shop, unprotected, and without giving the plaintiff any warning of its presence.

The plaintiff gave evidence in support of Counsel's statements and said she called the attention of the defendant to the ridiculous place in which the stove had been put.

For the defence, DAVID ANDERSON, an employé of an electrical firm, said that this stove or radiator was fitted up behind the counter, but had a flexible lead about two feet long; it was capable of scorching at a distance of six or seven inches.

Judge CLUER said he did not wish to hear any further evidence. Negligence had been alleged but not proved, and this stove was not in the nature of a trap. The stove was in a reasonable position and therefore there was nothing in the nature of a trap, as when it was on a certain amount of light would be given off, which could be seen by anybody using reasonable care. The plaintiff had not proved negligence, and judgment would be given for the defendant, with costs.

Theft of Radio Valves.

AT Old Street Police Court on May 28th, Arthur Ernest Peers, Bethnal Green, was charged with stealing five radio valves, value £2, the property of his employers, the London and North-Eastern Railway, from Bishopsgate goods depôt. He was found guilty and sent to prison for one month.

Stepney Councillor Fined.

The Times reports that on May 27th Daniel Frankel, Mile End Road, E., a member of the Stepney Borough Council, was at the Thames Police Court fined £25 and ordered to pay £5 5s. costs for unlawfully committing an act calculated to injure or to prevent the proper use or working of the shop and bakery of Israel Kossoff, by threatening to cause the electric power to be withdrawn. Evidence was given that during the recent strike the defendant, who was chairman of the Stepney Trades Council, sent a letter to Kossoff, from the "Stepney Council of Action," stating that the Council's attention had been drawn to the trade dispute which had occurred between him and his workmen, suggesting an immediate settlement, and stating that unless the council heard from him it would be compelled to consider the recommendation of a withdrawal of electric light and power as far as his premises were concerned. The defendant said that, as a fact, he was not aware at the time the letter was written that the current had been already cut off. The object of the letter was to prevent trouble arising, in view of the general strike.

False Pretences Charge.

AT Hull, on May 31st, Edward W. Clark was charged with having obtained £1,000 from Mr. W. F. Shuttleworth, a director of the Humber Electrical Engineering Co., by false pretences. It was stated that the accused had obtained nearly £8,000 in connection with patents which he proposed to exploit. The prosecution alleged that forged documents purporting to bear the signature of Sir George Thurston had been produced by the accused. Clark's counsel applied for bail, stating that previous patents of the accused were very valuable, but development had been retarded by the shipping depression. The accusations of forgery were denied. Bail was refused, and a remand to June 10th was ordered.

Reviews.

Industrial Electricity, Part II. By CHESTER L. DAWES, S.B., M.A.I.E.E. Pp. xv + 480; figs. 431. London: The McGraw-Hill Publishing Co., Ltd. Price, 13s. 9d.

The first volume of this work, which is concerned with direct current circuits, has already been noticed in our columns. The present volume, which, like its predecessor, is largely of a descriptive nature, deals at length with the flow of alternating current in circuits and with electro-magnetic appliances for use on alternating current mains. In addition, there are chapters dealing with the transmission and distribution of electrical energy, illumination and photometry (though little matter is given concerning the art of illumination), thermionic valves and their uses, and the interior wiring of buildings. The chapter dealing with the last named subject seems to lie outside the general scheme of the rest of the book and in any event will not be of general utility to readers in this country since it deals with methods and conditions which are usual in America.

The general mode of treatment in the book is one involving only the simplest mathematics, considerable use being made of wave and vector diagrams, though it is rather surprising to find that the chapter on the transformer does not contain a single vector diagram since one would have thought that they could have been used with good effect in explaining the action of this appliance. The chapter on the thermionic valve and its uses may be well commended as giving a very useful account of the present state of this branch of electro-technology.

The book appears to be accurately written and the only error of moment which we have observed is on page 74, where it is stated that the *natural frequency* of the oscillations of current in an oscillatory circuit is given by the expression $f=1/2\pi\sqrt{LC}$. This formula is only true if the resistance of the circuit is zero. When there is an appreciable resistance, though not of sufficiently large an amount to render the circuit non-oscillatory, the frequency of the natural oscillations has a somewhat different value which can be found by a well-known formula.

The work concludes with a large number of examples, including some dealing with purely trigonometrical matters which seem rather out of place. The value of these examples would be increased if answers were given to those involving numerical working.

The book is well supplied with illustrations, including many half-tone blocks, and will perhaps be found most useful by those engineers and students who are studying electrical engineering as a subsidiary subject and do not desire to enter too deeply into details of matters of an electrical engineering nature.

Illuminating Engineering. Prepared by a Staff of Specialists for Students and Engineers. Edited by F. E. CADY, B.S., and H. B. DATES, E.E. Pp. xiii + 486; figs. 162. London: Chapman & Hall, Ltd. Price, 25s. net.

This volume is something of a departure in literature on illumination. It is a textbook based on six years of experience of a course in illuminating engineering. The Editors are respectively Mr. Frances E. Cady, of the National Lamp Works of the General Electric Company, and Professor Henry B. Dates, head of the Electrical Engineering Department at the Case School of Applied Science, where the course was held. The fourteen chapters, based on this series of lectures, are contributed by experts on the various phases of illumination discussed.

This method of treatment presents certain advantages and also some possible drawbacks. Each subject being treated by an expert one may expect accurate and up-to-date information; but careful editing is necessary to avoid gaps or duplication of matter. On the whole the editors seem to have been successful in avoiding the latter difficulties. The earlier chapters are devoted to the physics of light-production and sources of light. It is desirable that students should have a good knowledge of such principles and the treatment is adequate. The nature of spectra, black body radiation, the distinction between incandescence and luminescence are discussed and the distribution of energy in the spectrum with rising temperature is illustrated. It may be noted that the highest luminous effi-

ciency theoretically possible, in the most efficient yellow-green region of the spectrum, is 670 lumens per watt, whilst a body radiating in much the same manner as the sun, but yielding no non-visible energy, would operate at about 250 lumens per watt. For black body radiation 90-95 lumens per watt is the limit—but even this is far greater than the highest efficiencies (10 to 30 lumens per watt) obtainable from commercial illuminants.

A brief account is given of the sun as an illuminant. Gaseous light-sources are then discussed, after which electrical illuminants are treated. This section is well done and incandescent lamps are particularly fully treated. We notice a complete and useful diagram comparing the distribution of energy in the spectra of the chief electric illuminants. Neon lamps are somewhat cursorily dismissed, whereas a considerable amount of attention is devoted to mercury vapour lamps and their operating mechanism. The apparent absence of any account of mercury vapour lamps using quartz tubes seems a rather marked omission. The space devoted to the Nernst lamp (following the treatment of vapour lamps and somewhat out of place), might preferably have been used for a brief account of the quartz tube lamp and the special nature of its radiation.

The treatment of photometry is on sound lines, though the illumination photometers described are either American or German; the Bechstein instruments (described as "Beckstein") are singled out for special reference.

After a chapter by Professor Cobb on Physiological Optics, we come next to the use of polar curves, calculations and various forms of globes, shades and reflectors. There is a table of foot-candle intensities, and it is interesting to observe that data are presented in two parallel columns, one containing "recommended" values, the other showing the range of illuminations applicable in practice. The ingenious "guide to the selection of reflecting equipment," in terms of efficiency, favourable appearance, glare, &c., which is a feature of recent American literature, is also included; 28 different typical units are thus illustrated and appraised. Other tables deal with coefficients of utilisation on familiar lines. The chapter entitled "Light Shade and Colour" makes interesting reading. The hints subsequently given on natural lighting of buildings are sound, though one misses any reference to the "daylight factor," widely used in this country.

The final chapters on applications (domestic and industrial lighting, illuminated signs, street-lighting, &c.), are well handled and contain a good review of these problems in the space available. The book is exceptionally well illustrated, and although it is naturally based on American experience and written primarily for students in the United States, it is well worth study by those in this country concerned with illumination.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 12th. In the case of foreign applications, the names and addresses of the British representatives are given in parenthesis:—

Elektrophit. No. 468,005. Class 4. Electrical and galvanic carbons, and graphite, raw or partly prepared, for use in manufactures. No. 468,006. Class 6. Brushes and commutators for dynamos and electro-motors.—The firm of C. Conradty, Nuremburg, Germany. (S. Sokal, 1, Great James Street, Bedford Row, W.C.1.)

Dimic. No. 466,936. All goods in Class 8.—L. McMichael, Ltd.

Ecco. No. 467,463. Class 8. Batteries, cells, accumulators, and Leclanché cells.—Ecco Battery Co., Ltd., 5, Bow Common Lane, E.3.

Millgate (lettering and design). No. 467,840. Class 8. Electric batteries (not for medical purposes), coils, coil holders, thermionic valves and holders, condensers, transformers, and headphones.—The Chorlton Metal Co., 60, Long Millgate, Manchester.

The Electro-Hit. No. 468,398. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Homophon Gesellschaft, Berlin. (J. E. Evans-Jackson & Co., 57-60, Holborn Viaduct, E.C.1.)

Deckorem. No. 468,477. Class 8. Apparatus for use in radio-telephony and telegraphy.—Arthur F. Bulgin, trading as A. F. Bulgin & Co., 9-11, Cursitor Street, W.C.2.

Antix. No. 468,077. Class 11. Lead glass, lead-loaded india-rubber and similar appliances for use as protection against X-rays.—Watson & Sons (Electro-Medical), Ltd., 43, Parker Street, W.C.2.

Perfecta. No. 466,817. Class 13. Steel tubes and steel electric conduits.—Perfecta Seamless Steel Tube and Conduit Co., Ltd., Birmingham.

Cosmos Lamps (lettering and design). No. 468,879. Class 13. Electric lamps.—Metropolitan-Vickers Electrical Co., Ltd.

Sax (lettering and design). No. 468,204. Class 18. Electric bells and alarms (as systems in buildings).—Julius Sax & Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

24,819. "Frequency and voltage regulation of self-excited dynamo-electric machines." British Thomson-Houston Co., Ltd. October 18th, 1923. (223,509.)

24,926. "Lamps for use in producing photographic records of electrical variations." T. W. Case. October 20th, 1924. (251,307.)

30,810. "Copying telegraphy." L. Semat. July 25th, 1924. (237,549.)

30,862. "Liquid rheostats." A. Gray (legal representative of B. Gray, deceased) and R. Curtis. June 16th, 1924. (227,431.)

1925.

1,151. "Rotary distributors for use in telegraph or like systems." Automatic Telephone Manufacturing Co., Ltd., H. H. Harrison, and S. R. Smith. January 14th, 1925. (250,996.)

1,632. "Electric coils." Fuller's United Electric Works, Ltd., and A. P. Welch. January 19th, 1925. (251,000.)

1,755. "Systems and apparatus for electric distant-control or signalling." M. E. A. Baule. January 21st, 1924. (228,166.)

1,883. "Electrodeposition of nickel." E. A. Ollard and Metropolitan-Vickers Electrical Co., Ltd. January 21st, 1925. (251,010.)

1,905. "Manufacture of fixed electric condensers." Paralite Compositions Co., Ltd., and W. A. M. Valon. January 21st, 1925. (251,012.)

1,984. "Vacuum electric tube devices." R. W. Lunt. January 22nd, 1925. (251,015.)

1,993. "Electromechanical telephone systems." F. Aldendorff. January 26th, 1924. (228,173.)

2,077. "Electrolysis or splitting-up of air or water." T. D. Kelly. January 23rd, 1925. (251,021.)

2,208. "Variable coupling-devices for alternating-current coils." British Thomson-Houston Co., Ltd., and J. Hutt. January 24th, 1925. (251,035.)

2,625. "Electric switches." British Thomson-Houston Co., Ltd., and P. T. Harris. January 29th, 1925. (251,034.)

3,182. "Thermionic valve circuits for wireless signalling and like purposes." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). February 4th, 1925. (251,041.)

3,519. "Electric generating plants operated by windmill power." L. Constantin and P. Fortier-Beaulieu. February 11th, 1924. (229,290.)

5,053. "Variable electric condensers." C. G. Hofman and L. C. Hofman. February 24th, 1925. (251,049.)

5,083. "Armatures for dynamo-electric machines." W. B. Sayers and P. Baxter. February 24th, 1925. (251,050.)

5,202. "Variable resistances." W. Knorr, W. A. Appleton and J. Joseph. February 25th, 1925. (251,053.)

7,200. "Electric connector or adaptor." General Electric Co., Ltd., and W. Manchester. March 17th, 1925. (251,068.)

7,648. "Electric switches." G. Edmonds, Ltd., and H. Edmonds. March 21st, 1925. (251,071.)

7,758. "Thermionic valves." W. R. Bullimore. March 23rd, 1925. (251,073.)

7,769. "Means for connecting electric conductors." F. V. Collins and L. F. Mayersbach. March 23rd, 1925. (251,074.)

8,172. "Receiving systems for high-frequency electrical oscillations." H. Wade (Carborundum Co.). March 26th, 1925. (251,078.)

8,243. "Electric cables." Siemens Bros. & Co., Ltd., A. E. Foster and H. G. Wood. March 27th, 1925. (251,081.)

8,686. "Electric fuses." Electrical Improvements, Ltd., R. W. Gregory and L. C. Grant. April 1st, 1925. (251,085.)

10,262. "Electric motors." A. H. Midgley. April 20th, 1925. (251,095.)

10,295. "Lead accumulators." Soc. Anon. Le Carbone. June 14th, 1924. (235,530.)

10,302. "Machines for helically winding wire on a travelling mandrel wire." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 29th, 1924. (233,330.)

10,372. "Lead accumulators." Soc. Anon. Le Carbone. December 11th, 1924. (Addition to 235,530.) (244,999.)

11,115. "Electric heaters." G. Wilkinson. October 5th, 1925. (251,099.)

11,390. "Sound-diaphragms and the like." Soc. Française Radio Electrique. May 3rd, 1924. (233,356.)

13,152. "Starting switchgear for electrical coal-cutting machines." W. A. Logan. May 20th, 1925. (251,114.)

13,354. "Loud-speaking telephone." C. A. Vandervell & Co., Ltd., and A. L. Murrell. May 21st, 1925. (251,116.)

14,361. "Sound amplifiers." C. H. Payne. June 2nd, 1925. (251,125.)

15,254. "Electric polyphase current arc lamps." E. Steinberg. June 12th, 1925. (251,129.)

16,012. "Relay mechanism responsive to voltage control." R. Wetzer. June 20th, 1925. (251,137.)

18,715. "Articulated coupling adapted to permit misalignment of two shafts, especially for power transmission in electric railway vehicles." Maschinenfabrik Oerlikon. September 1st, 1924. (235,179.)

19,276. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Bell Telephone Laboratories, Inc.). July 29th, 1925. (251,149.)

19,776. "High-voltage cables and methods of maintenance." Standard Underground Cable Co. February 5th, 1925. (247,143.)

19,810. "Loud-speaking devices for wireless receiving apparatus." J. Piquart. August 6th, 1925. (251,151.)

22,108. "Method of and means for use in binding insulated electrical conductors or insulating bare conductors or the like." P. F. Hellermann. February 9th, 1925. (247,147.)

22,760. "Frequency transformers." Telefunken Ges. fur Drahtlose Telegraphie. September 12th, 1924. (Addition to 238,559.) (239,873.)

23,806. "Device for indicating sparking and other disturbances and for automatically cutting-out transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Addition to 198,936.) (Divided application on 7,933/25.) (250,827.)

24,668. "Electric heater element." E. W. Moss (McClary Manufacturing Co.). October 3rd, 1925. (250,833.)

25,074. "Electrical driving arrangements for sewing and other machines." W. Fairweather (Singer Manufacturing Co.). October 8th, 1925. (250,835.)

25,132. "Indicator devices for variable electrical instruments, such as variable condensers, variometers, and tuning units." A. H. Midgley and Auto Sundries, Ltd. October 8th, 1925. (250,836.)

25,460. "Electric flue-gas testing apparatus." G. Sokolow-Winchnevsky. October 12th, 1925. (251,170.)

25,540. "Spacing device for electric accumulators." Soc. de Loye et Touzot. June 15th, 1925. (250,840.)

26,101. "Thermal time-lag relay." Schiele & Bruchsaler-Industriekonzern. October 18th, 1924. (241,587.)

26,354. "Electric welding." British Thomson-Houston Co., Ltd. October 25th, 1924. (241,915.)

27,063. "Electric contact-breaker arms." British Thomson-Houston Co., Ltd. October 30th, 1924. (242,293.)

28,539. "Electric jet-wave commutators and interruptors." J. F. G. P. Hartmann. November 12th, 1925. (251,189.)

28,600. "Dynamo-electric generators." R. Bosch Akt. Ges. February 3rd, 1925. (247,152.)

29,561. "Conductors with artificially increased self-inductance." Dr. U. Meyer. November 22nd, 1924. (243,390.)

29,652. "Spark-gap discharges for use in connection with electric condensers." Dubilier Condenser Co. (1925), Ltd. November 24th, 1924. (243,392.)

29,958. "Current-collecting devices for dynamos." Ruthardt & Co. Ges. November 27th, 1924. (243,753.)

30,368. "Rectifying installations for electric current." Siemens-Schuckertwerke Ges. December 2nd, 1924. (244,092.)

32,434. "Machines for making electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. February 21st, 1925. (247,923.)

32,474. "Electrically-driven vacuum cleaners." Soc. de Paris et du Rhone. December 24th, 1924. (245,148.)

1926.

1,288. "Vacuum-producing apparatus of the mercury-vapour jet ejector type." Akt. Ges. Brown, Boveri et Cie. August 10th, 1925. (251,213.)

2,125. "Traffic signals and like light-projectors." British Thomson-Houston Co., Ltd. January 24th, 1925. (246,514.)

3,687. "Alternating-current motors." British Thomson-Houston Co., Ltd. February 9th, 1925. (247,232.)